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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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NOTES ON DRY-FLY FISHING. No. 2.

By R. L. M., California.

In the first of this series of notes on dry-fly fishing I believe I was, to a certain extent, successful in dispelling the cloud of fog or mystery that surrounds the art in the mind of the average man; but before going any further into the technique of the dry-fly school, I propose to trace the history of this modern method of catching fish, which is described by Emerson Hough as being "the most beautiful form of the most beautiful sport." (Extract from a letter to the author.)

I have already remarked that, if a new fly is dropped on the surface of the water, it will float as long as it keeps dry. It is quite probable that those Macedonian fishermen mentioned by Aelian in "De Animalium Natura" (A. D. 230) were aware of this fact. Since this writer, the first who describes fly-fishing and a method of dressing flies, was not a very accurate recorder, we may take it that practically all his observations on nature were made second hand, consequently, we must not put too much reliance on his description of the flies used. Furthermore, the lengths of rods and lines that he states were used, were entirely too short for any practical purpose.

Scotcher ("Fly-Fisher's Legacy," 1807) makes, I believe, the first mention in print of the fact that a new fly will float. This fact, which can hardly be called a discovery, is known to every one who has ever fished to any extent with a wet fly. In a little book ("Anglers' Desideratum," 1839) the author, Capt. Clarke, R. N., describes a method of catching fish on hot sunshiny days, which has all the earmarks of dry-fly fishing with the single exception of floating the fly.

The late Emlyn M. Gill in his book "Practical Dry-Fly Fishing" (New York, 1915), writes of Mr. G. P. R. Pulman having "explained dry-fly methods in 1851." This explanation, which appears on page 132 of Pulman's "Vade Mecum" (1851, 3d ed.—the two earlier editions made no mention of the dry-fly) is not of very great length, so I will include it in this brief history:

> Let a dry fly be substituted for the wet one, the line switched a few times through the air to throw off its superabundant moisture, a judicious cast made just above the rising fish, and the fly allowed to float towards and over them, and the chances are ten to one that it will be seized as readily as a living insect.

Although the foregoing leaves very little undone to be a full description of dry-fly fishing, I do not think that in the light of latter-day evidence we can call Mr. Pulman a dry-fly man as the term is understood today. What he really did do was to emphasize the importance of the first cast with a new (dry) fly. His son in a recent letter told me: "I recollect that he (my father) often told me to dry the fly by flicking it about before taking a cast over a rising fish. He invariably fished down stream with two wet flies."

If we leave Mr. Pulman's description on one side as being doubtful, or of the nature of the Scotch verdict "not proven," the first real mention in print of dry-fly fishing is found in "A Book on Angling" (Francis Francis, 1867). Although there are over four hundred and fifty pages in this angling classic, only on three or four of them is there any slight reference to this new art of fly fishing. At the time Mr. Francis wrote this book he evidently did not attach any great importance to dry-fly fishing. David Foster ("The Scientific Angler," 1882) makes occasional references to dry-fly fishing and in some of the later editions there is a colored plate of dry flies. In the "Badminton Library" (1885) Mr. H. S. Hall gives a short but complete treatise of the art, together with the dressings for eighteen dry flies. Both Halford and Foster give Mr. Hall the credit for the invention or adaption of the eyed hook to flies of small size such as are used for dry-fly work.

The literature relating to the art may be said to have still been in an embryotic, if not a chaotic, state, when in 1886 Frederick M. Halford published his first work, viz., "Floating Flies and How to Dress Them." Besides fairly extensive contributions to periodicals devoted to sport, he found time in the following years to produce: "Dry-Fly Fishing in Theory and Practice"; "Dry-Fly Entomology"; "Making a Fishery"; "An Angler's Autobiography"; "Modern Development of the Dry-Fly"; and finally in 1913 "The Dry-Fly Man's Handbook." This last work has somewhat of an analogy to Rudyard Kipling's "Day's Work." Between its covers is epitomized the knowledge and experience of a lifetime devoted to fishing.

Of late years it has become the fashion among a certain class to question and even to ridicule some of his theories, but it should not be forgotten that Mr. Halford never put a line on paper until he had satisfactorily demonstrated its correctness by painstaking attention to detail and laborious study. If I may be allowed to use a distinctively

American colloquialism: "Halford put the dry-fly on the map"; that sums the matter up in a single sentence.

Among the other books devoted to the art I might mention "Fly Fishing," 1899, by Viscount Grey of Fallodon, or as he was known then, Sir Edward Grey.

On this side of the Atlantic besides Mr. Emlyn M. Gill's book already mentioned, the following have appeared: "The Dry-Fly and Fast Water," by George M. L. La Branche (N. Y., 1914); "Fishing with Floating Flies," by S. G. Camp (N. Y., 1916); and possibly one or two others.

The use of the dry-fly in America is of quite recent occurrence. The fact of the matter is that, until lately, our rivers and streams were swarming with fish that seemed only too anxious to rise to any artificial fly that was presented to them; but increasing population and better methods of transportation have brought many more men to the waterside in quest of sport than was formerly the case. The trout have become more wary and greater finesse has to be employed in their capture; consequently the dry-fly has been utilized as a means of overcoming their increased shyness. It is only to be expected that in England, with its denser population, these same conditions arose earlier than they did over here.

There are two rivers in the south of that country which are preeminently dry-fly streams. I refer to the Test and the Itchen. Sometime during the forties or fifties of the last century the dry-fly was first used on these waters. (See "Chalk Stream and Moorland," Russell, London, 1911).

To no single individual can be given the credit for the discovery, invention or development of the art of dry-fly fishing. I believe that what actually did happen is that different men hit on much the same thing about the same time. Their knowledge, which in the beginning was purely local and personal, became in the course of time more general, so that by the time the late sixties arrived, the art can be considered to have been fairly well established on these two rivers and on other streams of a similar character that are found in the south of England.

But although dry-fly fishing was quite common, so much so as to be considered the sole means of catching trout by some; in fact, Mr. Halford states that the dry-fly was used exclusively on the Wandle for the last half century, i.e., since 1863. (See "The Dry-Fly man's Hand Book," p. 66), it was not the universal method that it is today on these typical dry-fly waters.

"The Chronicles of the Houghton Fishing Club" were printed in 1908. This club has been in existence since 1822 and during most of that time leased or owned riparian rights on the Test. From the historical point of view there is not a great deal of information to be derived from a perusal of the Chronicles, which deal chiefly with fish caught and other matters; but we can glean some information both useful and interesting.

In the early days when the May fly (Green Drake) was up, the club members used to catch fish by "blowing." This consisted of using the natural fly as a bait together with a long light bamboo rod and a floss silk line. The wind was allowed to carry out (blow) the bait over the water, and by proper manipulation of the rod the fly was dropped on the surface just above a feeding trout. (Information contained in a letter from A. N. Gilbey, honorary secretary of the club, to the author; also see chapter XXIII, "Fishing," Vol. I, "Country Life Library of Sport" [London 1905].) "Blowing" was still practiced as late as the early nineties. The first mention in the Club Chronicles of the capture of a trout on the artificial May fly is on June 6, 1888; but a much earlier record of such a feat on the same part of this river is made by Col. Peter Hawker, of Longparish House, in his Diary, viz, June 11, 1817.

The sixties may be regarded as the transition period. During these years the dry-fly was becoming more common and the wet-fly was fast disappearing. Mr. J. Ernest Pain, who has lived at Chilbolton on the Test since the early seventies, told me that an old fly book belonging to an uncle, which was used in 1860, contained nothing but wet flies.

In the seventies the dry-fly was almost universal. Writing about the fishing on the Itchen from 1877 to 1880, Lord Grey remarks: "These Winchester trout taught us the necessity of using fine gut and small flies, and of floating the fly accurately over a rising fish." Even so the wet fly had not quite entirely vanished from these rivers. As late as 1890 a relative of mine who had owned fishings on the Test since 1850, told me that he never used the dry-fly and that he considered it a modern innovation that was quite unnecessary. As he had a number of fine specimen fish mounted in glass cases, his contention would seem to have been fairly proved; but such is not the case at all. My relative did all his fishing on his own private water where the trout were not harried by any one except himself and an occasional friend. There were weeks, nay months, when these fish never had a line cast over them and therefore we can readily believe that they could be taken on a wet-fly. The dining room of his fishing cottage projected over the river. There was a short distance on both sides of the house where fishing was never permitted, but his daughter told me that when her father and the keepers were away she used to catch these trout, with bread for bait, from the window. On the other hand at Winchester where Lord Grey fished, there were always a number of other men fishing and the trout became highly sophisticated. Earlier in his book Lord Grey speaks of the absolute lack of sport he experienced with the wet-fly on these waters, and it was not until he used a dry-fly that he had any success at all. ("Fly-Fishing," p. 108.) I consider that these facts amply prove the contention of most dry-fly men, viz: That fish can be and are caught with a properly presented dry-fly, which would not look at, much less take, a wet-fly.

Before the end of the last century certain rivers in England had become dry-fly waters, i.e., the use of anything but the dry-fly was prohibited, and it was regarded as a heinous offense to do otherwise.

The history of the art on this side of the Atlantic is brief; in fact I might almost say that it is in the making today. Dry-fly fishing has been practiced for some few years on the Catskill and other streams in the eastern states and is occasionally met with on our western rivers; but the necessity for it has not arisen except in a few localities where fishermen are almost as numerous as the fish. I learned the art in the eighties, but for years I fished almost entirely with a wet-fly, only occasionally using a dry-fly for an exceptionally cautious fish. However, of late years I have found the fish much wiser and not so easy to catch. The automobile is mainly responsible for this condition. Fifteen years ago I used to very rarely meet others bent on fishing, but nowadays I have frequently counted as many as ten men in sight at once lined out along the stream. Consequently I have been, for some years past, using nothing but the dry-fly; and I think it is only a question of time when the dry-fly will be much more generally used on American trout streams than it is at present.

THE YOUNG OF THE BLACK SEA-BASS.*

By Elmer Higgins.

One of the most picturesque fishes of Southern California, well known and appreciated by sportsmen and commercial fishermen alike, is the giant black sea-bass or California jewfish, *Stereolepis gigas* Ayres. It is a common sight to see one of these huge fishes hung up by the jaw before fish markets and on pleasure piers, surrounded by wondering tourists. But although over a million pounds are landed yearly in the markets, the fish caught all range in size from about three to six feet in length. The commercial fishermen never admit having seen a jewfish less than one and a half or two feet in length, and all declare them to be dull black in color and without markings, as are the larger ones.

Imagine our surprise then, when we discovered that certain pretty little bass-like fishes from the hauls of the boat "Albacore" were the young of the jewfish! These resembled the huge, ugly adults neither in form, color, nor markings, as may be seen from figure 1.

Several specimens of the young of the jewfish have been taken in the otter trawls of the "Albacore" in shallow water on the Southern

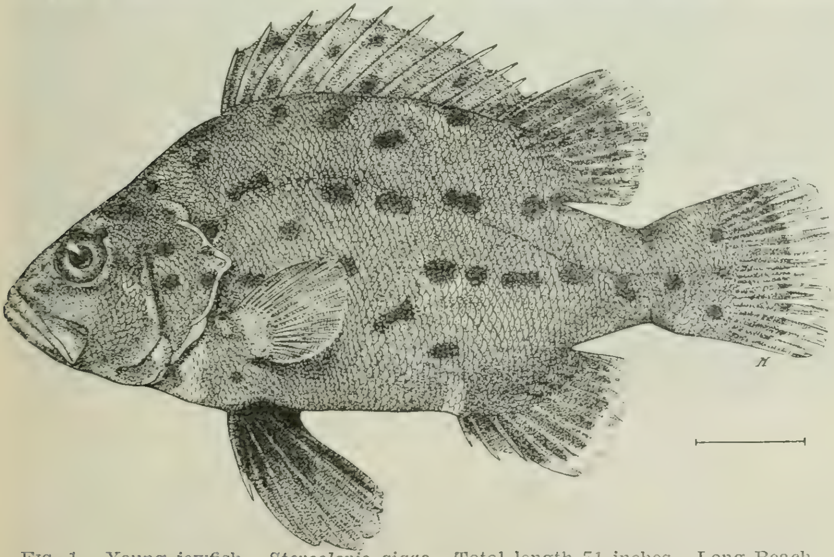

Fig. 1. Young jewfish. *Stereolepis gigas*. Total length 7½ inches. Long Beach, California, September 13, 1919.

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*California State Fisheries Laboratory, Contribution No. 13.

California coast at different dates: December, 1918, specimen 1½ inches long; April, 1919, specimens 4 to 4¼ inches long; and September, 1919, specimens 7½ to 9 inches long. The depths were from 4 to 15 fathoms.

The most striking change in the development of the jewfish is that of color and markings. The younger specimens are a rich brick-red in color and marked with conspicuous dark brown or black spots irregularly scattered over the back and sides. There are also white or pale yellow splashes here and there on the body, especially on the throat and ventral side of the tail. The vertical fins are black with conspicuous transparent edges, the ventrals black, and the pectorals pale or transparent. As the fish grows older the body color darkens and the spots become indistinct until the whole color is a uniform dark brown or dull black, except for the light patches on the throat and ventral surface of the tail which often persist even in the larger adults. All the fins become black except the ventrals, which, though black in the young, are lighter than the pectorals in the adult, showing white membrane between the black fin rays.

The change of form in the development of the fish is almost equally as marked. Figure 2, in which all the stages are reduced to one size, illustrates graphically the change in body proportions and size of fins, from the smallest specimen to the largest. It seems that the dorsal fin is practically submerged by the growth of the body, and indeed one or two of the dorsal spines are often entirely covered by the flesh. The remarkable change in the proportions of the pectoral and ventral fins is also evident. In the young the pectorals are about .23 of the body length and the ventrals are .40, while in the adult the pectorals are about .15 and the ventrals .12.

That the young of the jewfish or black sea-bass should be spotted or brightly marked is not surprising when we remember other closely related Serranoids which are brilliantly marked, such as our kelp bass, the striped bass, or the groupers of Florida and the West Indies, and it is indeed strange that they have not been recognized before. But the bright color and the different form of the body combined with the apparent inaccessibility, since they never appear in the markets, have protected the identity of this giant's young from the fisherman and public until the present time.

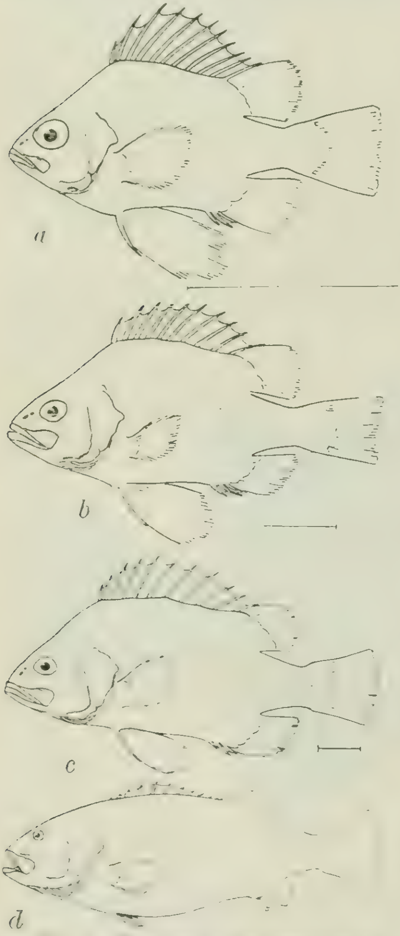

Fig. 2. Changes in the development of the jewfish. Size of specimens: *a.* 1½ inches long; *b.* 4⅜ inches; *c.* 9 inches; *d.* 72 inches (weight 305 lbs).

THE PACIFIC EDIBLE CRAB AND ITS NEAR RELATIVES.*

By Frank Walter Weymouth, Stanford University, California.

The edible crab of the Pacific Coast markets is familiar to most people but there are a number of other species less well known and somewhat likely to be confused with it. It is the purpose of this note to prevent this confusion. Since there are between fifty and a hundred distinct species, many of small size, on the coast, it is a mistake to imagine that any small crab is the young of the edible form. Many are so widely different that even a hasty examination will show the most uncritical that they are not market crabs, but there are four closely related species which are particularly liable to confusion and which will be considered in more detail.

The edible crab, *Cancer magister,* belongs to a genus which includes in the Atlantic two of the edible crabs of the eastern United States and Canada and the edible crab of Europe. On the Pacific coast there are nine species of *Cancer,* but most of these are so small or so rare that they need not be considered. Three or four species are large enough to be used for food but only *Cancer magister* is both large enough and abundant enough to be of commercial importance and is the only

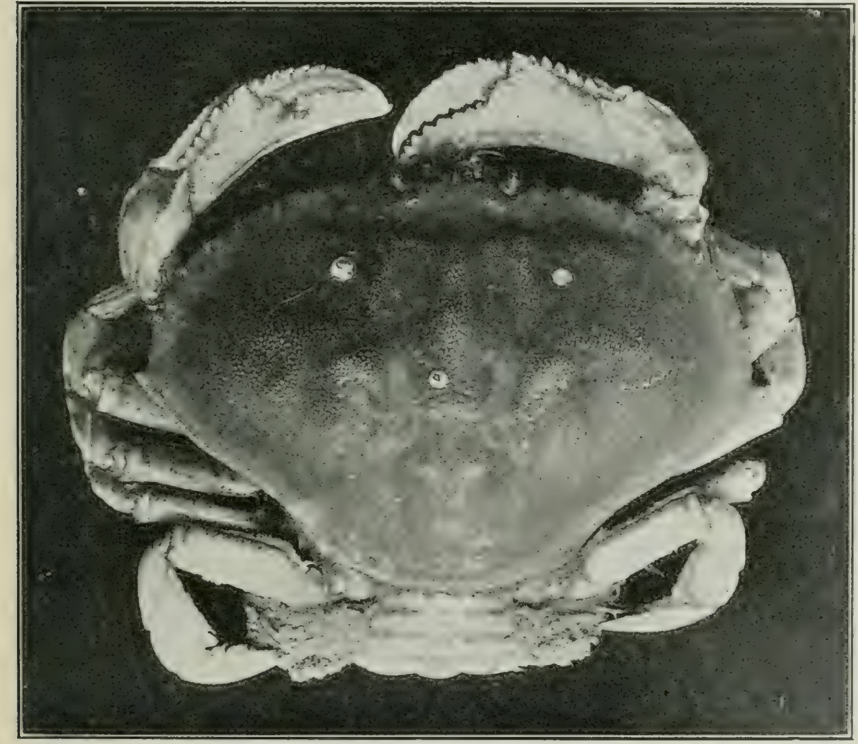

Fig. 3. Edible crab. *Cancer magister.* Egg-bearing female, one-half natural size. San Francisco, California.

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*California State Fisheries Laboratory, Contribution No. 14.

species recognized by the protective laws. The following descriptions and figures should serve to distinguish these larger and more closely related forms.

CANCER MAGISTER. EDIBLE CRAB.

Size large, sometimes reaching nine inches in breadth across the back from point to point. The general color of the living animal is not reddish and there is no red on the lower side; the teeth on the front and side of the shell are low and saw-like, those between the eyes are not all of the same size, and the two nearest the eyes are larger and more widely separated from the middle three; the "hand" of the large pincer has conspicuous rows of spines; the "fingers" are not black-tipped; and the last joints or "claws" of the walking legs are slightly curved, broad, thin and fringed with hairs forming swimming paddles. Seldom found between tides but usually in from one to twelve fathoms on sandy bottoms.

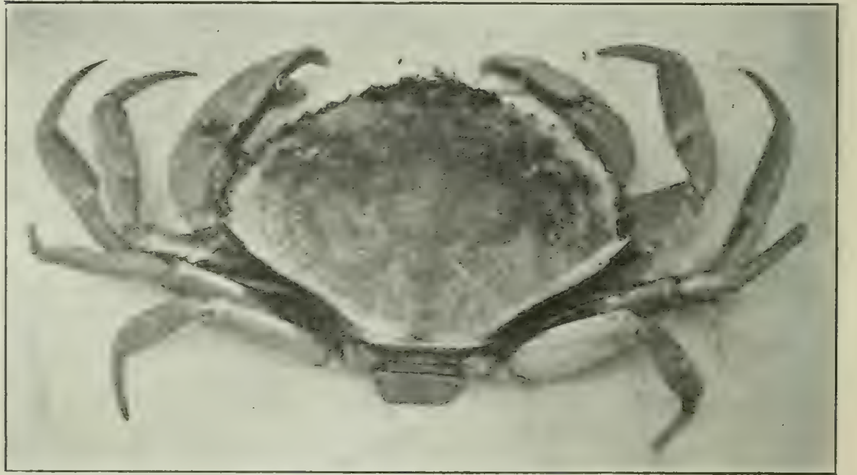

FIG. 4. Slender crab. *Cancer gracilis.* Male, natural size. Monterey Bay, California. The last joint of the last walking leg on the right is missing.

CANCER GRACILIS.

Size small, seldom exceeding three inches. General color of the living animal and teeth on margin of shell much as in *C. magister;* the "hand" is rather less spiny and the "fingers" are also not black-tipped; the last joints of the walking legs are long, curved, slender and hairless, thus differing from all the other species here described. In California not found between tides but in deeper water, usually on sandy bottom.

CANCER ANTENNARIUS. ROCK CRAB.

Size moderate, seldom exceeding five inches. General color of living animal reddish, lower side with small red spots not found in other species; teeth on front and sides of shell heavy, projecting and curved forward, those between the eyes much as in *C. magister;* the "hand" is large and entirely smooth, the "fingers" are conspicuously black-

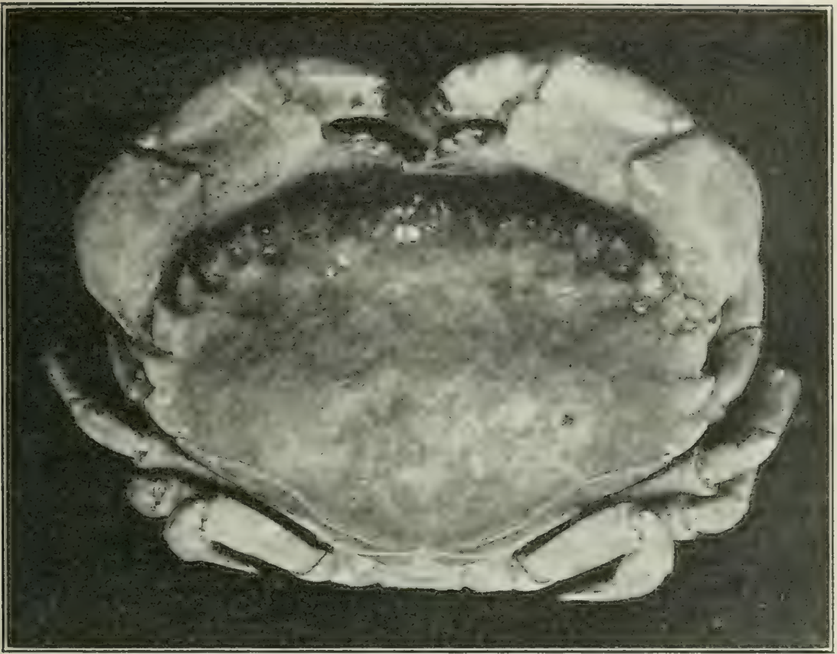

FIG. 5. Rock crab. *Cancer antennarius.* Male, two-thirds natural size. Monterey Bay, California.

tipped; the last joints of the walking legs are stout, nearly straight and hairy. Commonly found among rocks between tides, though also in deeper water.

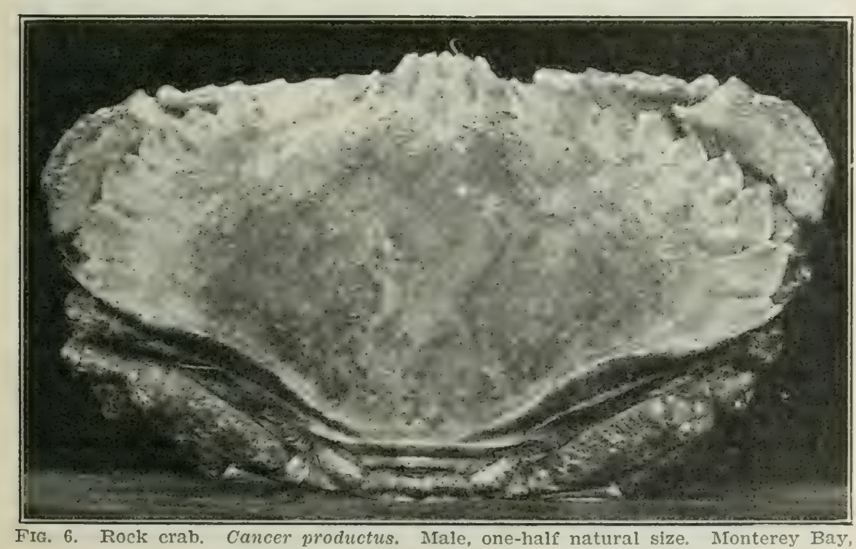

FIG. 6. Rock crab. *Cancer productus.* Male, one-half natural size. Monterey Bay, California.

CANCER PRODUCTUS. ROCK CRAB.

Size moderate to large, reaching seven inches. General color in life as in *C. antennarius* though there are no small red spots on the lower side; teeth on front and sides of shell similar to those of *C. antennarius,* those between the eyes of about equal size and projecting forward in front of the eyes thus differing from all the other species here described; the "hand" is roughened but without distinct spines; the "fingers" are black-tipped; and the last joints of the walking legs are straight and hairy but not flattened. Found usually between tides among the rocks though sometimes in deeper water.

THE PROPOSED INVESTIGATION OF THE SARDINE.*

By Will F. Thompson.

The marvelous development of the sardine fishery in California warrants close attention to it and its prospects of permanency. The sardine has indeed become the most important species among the many utilized in our great fisheries. In 1914 few were canned, but each year has seen steady increase in number of canneries and in the total packed. It is well nigh impossible that this giant industry which has grown up over night should continue to grow at the rate it has in the past, but an increase is surely still to be expected. It is a growth unparalleled within the countries bordering the Pacific, and its effects are consequently well worthy of attention. This attention is especially due from the state, which has legal jurisdiction over the fisheries and is responsible for their continuity. But such observation, it should be carefully noted, is as much for the prevention of hasty and harmful legislation as for conservation.

Moreover, many of the unsolved questions of fishery science and many of the practical questions concerning the course of the annual "runs" of fish may expect at least partial answers from an energetic investigation of the life history, as has been previously pointed out by the writer in Fish Bulletin No. 2 and in California Fish and Game, Vol. 5, No. 2. The trend of the program of investigation, practical as it is, is therefore aimed at a solution of "purely scientific" questions as well as more "practical" and immediate ones.

In order that this program may be formally on record and that it may be open to discussion by anyone, it is hereby published in the form of the principal questions which it seeks to answer. Suggestions and criticism are earnestly desired from every possible source.

The law requiring this work is as follows:

> It shall be the duty of the fish and game commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes; to make such investigations of the biology of the various species of fish as will guide in the collection and preparation of the statistical information necessary to determine evidence of overfishing; to make such investigations as will bring to light as soon as possible those evidences of overfishing as are shown by changes in the age groups of any variety of fish; to determine what measures may be advisable to conserve any fishery, or to enlarge and assist any fishery where that may be done without danger to the supply.

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*California State Fisheries Laboratory, Contribution No. 15.

1. Will depletion occur?

To answer this we must have:

A. The catches by each boat, their character and the artificial limits affecting them, in order that comparisons may be made of the catches of the various years, and of the seasons.

B. The type of each boat and the apparatus used.

C. The method of the fishery, and the effects of such factors as the moonlight.

D. A knowledge of any decided changes in method or location of the fishery.

E. An answer to the following question, No. 2.

2. Are there great natural fluctuations in abundance, or quality, other than those of depletion?

An answer requires:

A. The same data as are required to answer No. 1.

B. The composition of the catches each year according to size or age, in order that we may discover whether a good catch is due to an exceptional spawning season. This implies a knowledge of the effect of selective fishing on the catch.

C. The variation in the composition of the catches during various parts of the year, so that we may be sure we are comparing the years correctly.

D. The spawning season, and its relation to natural changes in quality or local abundance.

3. Is it possible to foretell fluctuations?

This can not be done unless we know:

A. What changes are invariable each year, such as the spawning migration.

B. What the success of each spawning season is, as evidenced by the abundance of the youngest fish. It may be necessary to judge of this by comparing the abundance of the youngest in separate classes, such as medium or large fish.

C. What the age and rate of growth is, so that we may know how long it takes for the fish of a given spawning season to become fit for use.

4. Do sardines migrate from one region to another?

This question is of importance because of the possible difference in food value of sardines which live in the various regions; because of the possible depletion of one region independently of another; or because of the possible dependence of the supply in one region upon the sardines in another.

The data required are:

A. Extensive measurements to discover any physical differences between schools from different regions. For example, a difference in size of the head would indicate that the schools did not mingle but were independent.

B. The early life history, especially that of the eggs and their drift with the currents.

C. The location of the various age classes of fish at the different periods of the year, so that seasonal migrations may be discerned, and the simultaneous character of fluctuations in different regions may be discovered, if existent.

D. The accessibility of the schools under various physical conditions, to explain any absence which might erroneously be assigned to migration.

5. If depletion should occur, what measures for protection should be adopted?

For the proper solution of this problem, an intimate knowledge of the life-history is necessary, but the following will constitute the most practicable basis for action:

A. Are the sardines in different regions independent? May one region be depleted and another not?

B. When are the sardines worth least as food? When are they most valuable to the species as spawners?

C. Upon what classes of fish does the strain of the fishery fall most heavily?

In answering these questions it is obvious that extensive data must be gathered. We are undertaking the collection of careful statistics regarding the boats and their catches, and are observing the sardines closely throughout their season. This implies the obtaining daily of material from the canneries and fishermen. We trust that this privilege will be cheerfully granted, and the agents of the Commission have been instructed to use the utmost care that no unnecessary inconvenience is put upon any person or firm in the pursuit of duties required of them by law.

THE LIFE HISTORY OF THE SAGE HEN.

By E. H. Ober.

The sage hen is the largest upland game bird found in California. Consequently it is not easily confused with any other bird. As a prominent zoologist has said, "It is not particularly necessary to describe the sage hen any more than the elephant, as its size and its extremely long and pointed tail proclaim its identity anywhere."

The high open plateaus from six thousand to twelve thousand feet in elevation constitute its home, the birds seldom frequenting country where timber grows to any extent. As a rule, sage hens do not migrate from their accustomed locality, no matter what the weather conditions may be. When snow covers the ground they resort to high brush which protrudes through the snow, where it is possible for the birds in severe blizzards to dig or scratch down to the ground at the base of a bush. At such times when the snow is deep and frozen, sage hens fall easy prey to the marauding coyote, lynx, skunk, and various other varmints that follow their scent each winter.

During clear spells throughout the winter sage hens keep on the go searching for food that has been blown over the snow. Strange as it may seem, at such times birds are the very wildest of any time during the year.

Early spring usually finds the birds poor in flesh and shabby in plumage. The females select the sunny slopes and hillsides, near springs or small running streams, for nesting grounds. A feeble attempt at building a nest is made by scratching out a shallow hole in the ground at the foot of a sage bush, or other shrub. Here the eggs are laid, the usual number being about ten. In color, they are greenish and speckled with brown; in size they are about that of a small domestic hen's egg. Old male birds never frequent the locality in which their mates nest and only return when the young birds have reached maturity. The percentage of their brood brought forth each year by the nesting hens is exceptionally good considering the immense disadvantage the birds are subjected to during their nesting period. By this I mean varmints of all sorts, early spring floods, trampling by sheep, cattle, and horses, and last but not least, the man with the gun, who formerly was always to be found following the snow back as it receded from the lower hills. Many young birds fall early prey to varmints, as the parent bird has feeble means of protecting herself or her young.

While the sage hen is nesting, and for a short while after the female comes off with her brood, the food consists mainly of the tender buds and leaves of blue brush, and wild cherry brush. After the young birds have learned to fly, they descend along the larger streams, also frequenting meadowlands, where small, tender weeds and young grasses are added to their diet. At such places the young birds will gather in large flocks and when approached by man, will stand and crane their necks and make a very faint attempt at cackling. When closely approached they usually run rather than fly.

By the last of August or early September the young birds are usually joined by the old male birds, which come off the higher slopes and ridges. These old male birds stay very high up all summer long, quenching their thirst from the snow banks.

The cock sage hen's performances in early spring are most interesting. He struts very much like a turkey, his long pointed pheasant-shaped tail spread out like a fan. The wings trail beside him, the breast nearly rubbing the ground. In some instances the breast does rub the ground, and the feathers are worn off. During the courting antics the male inflates his saffron-colored air-sacs on both sides of the neck and makes a guttural sound, stepping much as does our turkey gobbler. All of this performance is apparently directed to attract the attention of the females, which gather together old and young, big and little.

The sage hen is by nature terrestrial; flying at best is a laborious performance and only resorted to as a last expedient. With much effort a bird lifts itself, but when once in the air it flies rapidly, and I have seen them sail for two miles or more before alighting. Sage hens are not suspicious birds. They generally walk or run away from an intruder, sometimes hiding among the sage bushes, where, owing to their protective coloration, it is quite difficult to detect them without a bird dog.

In October, sage hens congregate in large flocks, and feed almost entirely on sage and soon lose their gamey flavor brought with them from their higher homes.

The principal diet of the sage hen throughout the year consists mainly and almost exclusively of sage and a great portion of bitter brush, along, however, with a certain amount of flower buds and bulbs. It is about the only bird known that can eat with relish, and benefit, the leaves of our common sage brush, and subsist upon that food indefinitely. In fact, there are various kinds of herbage that sage hens are known to pick up during certain seasons of the year aside from sage, but such only in very small quantities.

The sage hen is one of our grandest game birds, a bird that should be carefully guarded to prevent extinction. The young birds are often alert and rise from the ground at some little distance at the approach of man on foot or horseback. If the hunter marks them carefully when they alight he has no trouble in walking within easy shooting distance. When flushed, the sage hen almost always flies behind the hunter making a turn in the air just after leaving the ground, thus making it a large and easy target. Like most of our ground birds it does not fly from cover at the crack of a gun.

The writer recalls about twenty years ago when thousands of sage hens made their homes in Long Valley, which is in the south end of Mono County and just northwest of Inyo County's north boundary line. At that time it was considered mere play for the cowboys to dash with their saddle horses into a large flock of sage hens, one thousand or more, and strike down two or three with their quirts or cow whips before the birds could possibly get out of the way. Conditions now, however, have changed. Of the thousands which a few years ago inhabited our plateaus, now only a few scattered hundreds remain. Indeed, the situation regarding the future welfare of the sage hen throughout California was most alarming until the stringent laws of recent years became effective.

NOTES ON THE LIFE HISTORY OF THE BLACK-TAILED DEER.

By J. D. Coffman.

Though the black-tailed deer, *Odocoileus columbianus,* is well known and widely hunted, yet its habits and life history are but imperfectly known. We therefore offer the following notes, which have been compiled in connection with a report sent the California Fish and Game Commission by the Trinity National Forest, as a contribution to the life history of this notable game mammal.

With the heavy snows on the higher ranges, the deer descend to the lower elevations and during the winter feed on such bunch grass and browse as is available, utilizing moss, mistletoe and branches broken off by snow where the more palatable forms of forage are unavailable. During this period of the year the deer travel in bands. As the snows melt away they follow the snow line back to the higher ranges and during May and June scatter out through the mountains. During the spring they feed on open glades, but after the middle of June most of the deer ascend to the higher slopes, feeding on tender shoots and grasses during the early summer, and almost exclusively on browse, such as hazel, oak and various species of Ceanothus (blue brush, buck brush, wedge-leaf (chaparral), and white-thorn), from early August until the acorns are ripe in the fall. Then mast forms a large proportion of their food within the oak country. In the fall, after the rains have come, deer will also dig for roots and ground shoots, and feed extensively on the edible fruiting bodies of certain species of fungi that develop abundantly in the timber at that season. During the summer season deer use natural mineral springs and salt licks extensively.

It is noted after extremely cold and snowy winters that a few deer appear to die from the effects of the storms, deer so dying being found late in the winter or in the early spring after they have commenced feeding on the open grass lands. For this region (the Trinity National Forest) the rutting season begins early in November and ends about the middle of December, depending a great real upon the altitude where the deer happen to be feeding, the mating beginning several weeks earlier in the lower elevations than at the higher altitudes. On the lower lands within the watershed of the north fork of the Eel River, in the southwestern portion of the Forest, the rutting season begins about one month earlier than the general season stated above.

It is a common belief among the old residents that the first heavy storm during November has considerable influence upon the rutting season. This may, however, simply be due to the fact that these storms appear usually about the time the deer start to run, and the impression may also be due to some extent to the fact that the tracks are so much plainer in the snow that it creates the impression the deer have been running more, and it is probably true that the deer would move around more after the advent of snow even aside from the rutting season.

During the running season the bucks frequently fight each other, and many of the old ones have torn ears from their horned encounters with their rivals. The bucks at this time become thin, as a rule, and the meat is usually unfit for food even though the buck may appear to be in good condition.

The young are born during the months of May, June and July. The does first breed, therefore, when they are approximately eighteen months old. In their first breeding season they bear but one fawn as a rule, and very often but one during the second season, but thereafter bear two fawns, and in rare instances three. Until such time as the fawns are able to follow the does, they are hidden away in a brush patch or sheltered nook, while the mother feeds near by, returning to them at intervals during the day. After the fawns are able to travel, their beds or hiding places are changed frequently until such time as the fawns are able to follow throughout the day. During the first six weeks the fawns are said to have no scent, the scent glands probably not having developed as yet. This undoubtedly protects them materially from their predatory enemies. Even with this protection, probably not as many as fifty per cent of the fawns reach maturity. Most of the fawns have lost their spots by September and are weaned during the fall. The fawns usually remain with their mother until they are yearlings or until the next fawns are born, and frequently stay with her even for several months longer.

The bucks shed their antlers during January and February. During March they have only a skin covering over the old scar, and the new antlers begin to grow in April. During the months of June, July and August the antlers are in the velvet and are tender, so that the bucks remain in the open timber or around rocky places, and do not frequent brush areas. During the latter part of August and the first half of September they rub the velvet from their horns. About November 1 the bucks' necks begin to swell, and they do considerable traveling around just previous to the rutting season.

The summer coat of all the deer is of a reddish color, and the winter coat is of a bluish-grey color and is heavier than the summer coat, the hair being longer. The winter coat is shed during May, and the summer red is worn until September, when the winter coat begins to come in again. Occasionally a white or albino deer is seen or killed, and also black deer, both being rare varieties of the common local species.

During the latter part of August and the month of September most of the deer range at high elevations and lie in heavy brush thickets as a protection against flies, and perhaps to escape hunters and their other enemies as well.

CALIFORNIA FISH AND GAME

A publication devoted to the conservation of wild life and published quarterly by the California State Fish and Game Commission.

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The articles published in California Fish and Game are not copyrighted and may be reproduced in other periodicals, provided due credit is given the California Fish and Game Commission. Editors of newspapers and periodicals are invited to make use of pertinent material.

All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

January 15, 1920.

"Game laws are not enacted for the purpose of depriving any citizen of his rights, but rather to prevent such deprivation by assuring a supply."

FIVE YEARS OLD.

California Fish and Game is now five years old. If you are not aware that it has grown in size, compare the first issue with the recent trout number. But physical growth is not everything. We trust that there has been a growth in the so-called "general tone" of the magazine as well. It is to be hoped that each issue acts more and more as an evangel of conservation and that the material presented increasingly convinces the reader that California's wild life resources are worth something and consequently need to be conserved.

California Fish and Game was started as a means of moulding public opinion, for it was believed that: "The effectiveness of game protection is governed by the interest of the people and the spirit of those who hunt and fish." To judge of its effectiveness in this regard is perhaps difficult, but it is certain that there has been a growth of public opinion favoring the protection of wild life resources, and we believe the magazine has helped in this development.

You will find in the volumes completed noteworthy facts concerning the status of fish and game in California and the means being taken to conserve it. The magazine has acted primarily in an educational and publicity capacity, but it also constitutes a record of activities and accomplishments which are of historical value.

In looking toward future numbers what more can we do for the cause? Our magazine has not entered the field of the sporting magazine. Articles seldom appear in story form and the usual hunter's experiences recounted in characteristic fashion are omitted, and for that reason it may not be so readable. The adherence to scientific fact, however, should carry added importance to the reading matter, even if popular and light reading is lacking. It should be remembered that the function of our magazine is quite different from that of a typical sporting magazine.

If California Fish and Game is not living up to its motto "Conservation through Education," let us immediately receive a set of protests from our readers.

WE MUST CAPITALIZE OUR RESOURCES.

More and more we are awakening to the fact that fish and game propagation and protection is a business proposition. One of the most convincing arguments for the conservation of wild life resources is to be found in the attractiveness of fish and game to sportsmen outside of the state, who benefit the state by spending large sums of money in obtaining their sport. It is up to us to capitalize all of our resources—climate, mountain scenery, forests, fish and game. When capitalized it does pay dividends. These dividends, however, continue only when fish and game are properly conserved. Had a sufficient breeding stock of that most valuable of all the fur-bearers, the sea otter, been maintained the state would now be obtaining a return from a splendid industry. The practical extinction of this valuable fur-bearing animal precludes any return. With a little foresight California can so conserve its supply of wild life that it will form a permanent and paying attraction to the pleasure seeker. With a little indifference California can become bankrupt so far as invested capital in natural resources is concerned, with no hope of solvency.

EDUCATION VERSUS LAW ENFORCEMENTS.

Since the beginning of the educational campaign in this state to establish a public sentiment favorable to fish and game conservation, we have continually pointed out the advantages of the educational method over that of force. The necessity of a patrol force is largely due to the lack of proper public sentiment. The most fundamental way of cutting down the number of violations is to let people know something about the wild life of the state and its needs.

State after state is coming to a realization of just these facts. New York is doing some splendid educational work, Michigan has been devoting a great deal of energy to an educational program, and now we note that Wisconsin has begun an extensive program of education and has been employing speakers to deliver lectures throughout the state. The results have been so much worth while that an enlargement of the program is planned. According to the Wisconsin Commission "it is the one thing that will save the wild life of the state and the work must be pushed vigorously. Until such time as the people become educated to the importance of a united public sentiment for conservation we must pursue the course of warrants, courts and fines and follow the old method of educating with the sledge hammer, teach through force instead of reason and the more rigid the laws and the more severe the fines, the more potent the effect."

FUR RESOURCES ENDANGERED.

That it is high time each state turned its attention to giving judicious protection to fur-bearing mammals is evidenced by the following statements given in a recent Farmers' Bulletin (No. 1079) of the United States Department of Agriculture:

"Recently the supply of peltries has been decreasing at an alarming rate. Raw-fur buyers representing all parts of the country place the decrease at from 25 to 50 per cent during the last ten years. There are no longer any virgin trapping grounds. Even in Alaska the two most important fur-bearing animals, the beaver and the marten, have become so nearly exterminated that they are now being protected by a close period.

"Laws protecting fur-bearing animals are designed to keep a steady flow of peltries coming to market year after year, thereby bringing trappers a reliable income and giving regular employment to thousands of people engaged in dressing skins, manufacturing garments, and distributing them through the various avenues of trade.

"A general protest comes from raw-fur buyers against traffic in unprime skins. The losses caused by killing fur animals when their pelts are not prime are enormous. An educational campaign is greatly needed to prevent this waste and to perpetuate our fur-producing resources."

NEW GAME FISH IMPORTED.

On November 24, 1919, the California Fish and Game Commission received a shipment of ayu eggs on the steamer Shinyo Maru from Japan which were sent through the courtesy of Professor C. Ishikawa, College of Agriculture at Komaha, near Tokyo (Tokyo Imperial University), Japan.

The eggs were deposited on cocoanut fiber and placed in four jars holding about a gallon to a gallon and a half of water each. There were also three tubs about thirty inches in diameter which contained approximately three to four pieces of fiber each. The ayu eggs are very small, not much larger than the eggs of the shad. As soon as the consignment arrived in San Francisco the eggs were hurried to the Brookdale Hatchery and were placed in the hatching troughs at that place, where they are at the present time. Upon arrival the eggs were apparently all dead but since this Commission is very anxious to give this experiment a thorough test every precaution was taken in the handling and placing of the eggs in the hatchery troughs in case any life should develop.

The Commission feels greatly indebted to Dr. David Starr Jordan of Stanford University, who originally corresponded with the Imperial University at Komaha near Tokyo, and it was through his efforts that the shipment was received. The ayu is a sporting fish belonging to the trout family and it will make an excellent fish for the anglers. It reaches a length of 8½ inches; none are to be found in this country.—E. D.

CALIFORNIA FURNISHES STRIPED BASS TO HAWAIIAN ISLANDS

On Saturday, November 15, 1919, the California Fish and Game Commission shipped about 2500 striped bass from 2½ to 5 inches in length to the Fish and Game Commission of the Territory of Hawaii to be planted in streams in the vicinity of Honolulu. Captain H. E. Foster of the patrol launch "Quinnat" had charge of the seining crew which collected the fish on the Benicia flats by means of a beach seine 270 feet long, 12 feet deep, the bag of which was ½ inch mesh and the wings 1½ inch mesh. It took about three days to make the catch.

The fish were held in live cars until sufficient were collected to make the shipment and then were put aboard the Matson Navigation Company's steamer "Maui." Here the fish were distributed in six large salmon tierces that had been arranged on the main upper deck in front of the office of the chief engineer, Alexander Ryan, who took personal charge of the fish on the trip. Each tierce had salt water circulation by means of a small pipe which had been connected up with a pump in the engine room.

In 1874 California received the first shipment of 150 small striped bass from New Jersey. These fish were distributed in the Sacramento and San Joaquin rivers. In 1882 a second shipment of 400 striped bass were sent to this state by the United States Bureau of Fisheries. California has an annual catch of about 1,500,000 pounds of striped bass, with a commercial value of about $150,000. Since so fine a result was obtained with a small number of fish in California the large plant of 2500 fish in the vicinity of Honolulu should assure the rapid establishment of this splendid fish in the Hawaiian Islands.—E. D.

STREAMS NOW STOCKED WITH GOLDEN TROUT.

The angler who visits the Southern Sierras during the next few years will be elated to discover the streams teeming with Golden Trout. Heretofore the "most beautiful trout in the whole world" was limited to a few high mountain streams in the vicinity of Mount Whitney, and the angler was forced to take a long hard pack trip in order to secure this trout. Now, owing to the operations of the California Fish and Game Commission the golden trout is to be found in mountain streams from the southern boundary of the Yosemite National Park to the tributaries of the Kern River.

In the beginning Golden Trout were caught with hook and line and then transported by mule pack train to other streams which were to be stocked. Now the fish are spawned and the eggs hatched at the Mount Whitney hatchery and then distribution is made. During September and October of this year large plants of golden trout have been made in the headwaters of the Kings River, thus extending the distribution of this fish over fifty miles to the northward. Former plants had already extended the distribution more than one hundred miles to the northward. Every effort is being made to extend the range of this notable trout, care being taken, however, to keep a pure strain by planting in barren waters. As results of former plantings have been very successful, it is expected that golden trout will be available to everyone within a few years, and that the lakes and streams of the southern Sierras will be the Mecca of anglers the world over.

IN MEMORIAM.

OSCAR H. REICHLING.

It is with deep regret that we record the death of Oscar H. Reichling, Cashier of the Fish and Game Commission, which occurred on Sunday, November 9, 1919.

Mr. Reichling was appointed a special deputy on October 24, 1903, while living at Jackson, Amador County. Impressed with the frequent flagrant violations of the laws protecting wild life, particularly by the foreign element, Reichling saw that unless the laws were enforced that it would be only a short time until there would be no game or fish. As a citizen, he did what he could to stop the violations, but found that he was handicapped by not having authority to make arrests. He corresponded with Chas. A. Vogelsang, who was then Chief Deputy, and through him received an appointment. While acting as a special deputy, he made an excellent record and when, with the advent of the Hunting License Law, it was possible to employ more regular deputies, because of his record, he was given a permanent appointment, March 24, 1908, with headquarters in San Francisco.

As Mr. Reichling was exceedingly painstaking and accurate and had early training as a bookkeeper, it was found that he could best be used in this capacity and he was detailed to assist the late Judge E. G. Heacock, then in charge of the license and bookkeeping department. Upon the death of Judge Heacock, in 1909, he was again promoted. Later he was given the very responsible position of cashier, the place he held at the time of his death.

Mr. Reichling is survived by his wife and mother and also by three brothers and sisters. He was a member of Excelsior Parlor, N. S. G. W., and is mourned by a host of friends.

—J. S. H.

SAVE KLAMATH LAKE BIRD RESERVATION.

California today is one of the greatest out-of-doors states in the union. Its mountains, lakes, forests, rivers and wealth of bird life attract people from every state in the country. Every man, woman and child in this state owes Theodore Roosevelt something for his far-sightedness and for his efforts in saving the wild birds of the state. They not only owe something in the way of a cash contribution to a memorial for his far-sightedness, but they owe some effort toward saving these greatest living and useful monuments which he preferred to any other kind.

Although Lower Klamath Lake is a federal wild bird reservation by special proclamation and wild birds are carefully protected by both state and federal law, yet the vital defect in the whole situation is the present unfortunate condition which is bringing about the destruction of bird life on a vast scale and the annihilation of this great reservation by the drying up of the lake. The myriads of ducks, geese, wading birds and other wild fowl are at home in the wonderful marsh land, but they can not exist on the alkali flats of the desert.

Picture to yourself the condition a few years ago when Roosevelt created the Klamath Lake reservation. Here was a wide, open, shallow alkaline lake ten or twelve miles long. For miles and miles around the border was a vast tule marsh, white with the nesting multitudes. The beauty of Lower Klamath Lake was in its life, the flying birds that hovered over the wide, treeless area, the calling flocks that from time immemorial have held this as their own. Around the wide border of the lake a wild swamp grass grew, nurtured by sub-irrigation, and a great number of cattle were raised here.

Then came the land operators and wildcat schemers and advocated the drying up of the lake by cutting off its water supply from Klamath River. They said instead of a marshy waste we could have a great farming area. A dyke was built and a change has gradually taken place. Instead of the waters, we now have desert flats crusted with alkali. The meadows of wild grass owned by stockmen about the lake have reverted to the desert because of the lack of water. The great tule marsh, as dry as tinder, and the peat two or three feet below the surface, was set on fire last spring and is now a gigantic waste, flaming in some places and slow burning under the surface in others. The migratory flocks that have fed and nested here are flying about without homes and resting places.

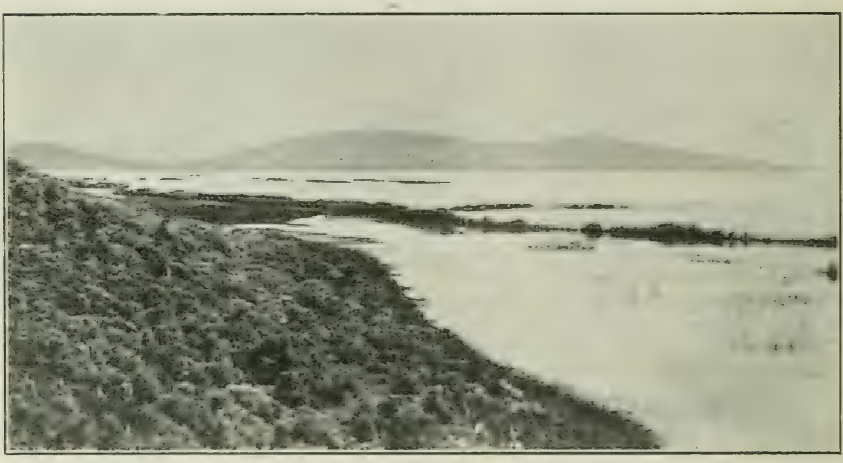

FIG. 7. Lower Klamath Lake, a federal bird reservation, from the west shore of the lake. An abundant tule growth on the east side of the lake forms an especially fine breeding ground for waterfowl and the islands in the lake are used as breeding grounds by cormorants, pelicans and great blue herons. Photograph by H. C. Bryant, June 9, 1914. (Neg. 1269, Calif. Mus. Vert. Zool.)

A. P. Davis, director of the reclamation service, has written Senator Chamberlain that a recent investigation of the marsh lands around Lower Klamath Lake has failed to disclose positive evidence of their value for agricultural purposes. According to his own words "very little conclusive evidence can be found as to the agricultural value of the lands around Lower Klamath Lake."

Here is the most useless piece of destruction of one of our greatest out-of-door resources, and nothing gained. The whole thing can be remedied if the reclamation service will open the dykes and let the water back into Lower Klamath Lake. Every citizen of the state should take this matter up with the reclamation service, our senators and representatives in Washington, or with the Secretary of Agriculture. If immediate action is secured Klamath Lake Reservation could be restored and would remain as a great living monument to Theodore Roosevelt.—W. L. FINLEY, *State Biologist*, Portland, Oregon.

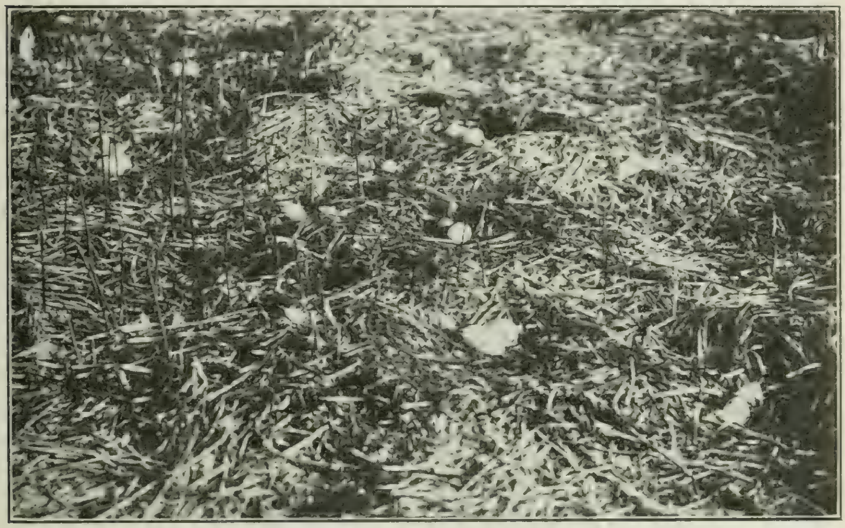

FIG. 8. Nests of pelicans and cormorants on Bird Island, Lower Klamath Lake. Photograph by H. C. Bryant, June 8, 1914. (Neg. 1276, Calif. Mus. Vert. Zool.).

THE HUNTER'S LAMENT.

"Of what earthly use is it to protect waterfowl from overshooting and then take away their nesting grounds, their feeding waters and the places where they rest on migrations? It is of the utmost importance that public waters be preserved, if we are to maintain duck shooting."

So says the American Game Protective Association with reference to the drainage of Big Rice Lake in Minnesota under the pretext of land for the farmer.

So say we all of us with reference to the Klamath Lake Bird Reservation and other wildcat schemes which threaten the extermination of our wild life resources.

SOUTHERN CALIFORNIA FISHERIES FILMED.

In order to inform the people of the state as to the wonderful fisheries which have been developed in Southern California the past few years, the Fish and Game Commission has recently had a film made depicting the outstanding features of the tuna fishery. After spending many days aboard the launch "Albacore," of the Fish and Game Commission, the camera man secured a very fine series of pictures showing the methods of capturing the fish. Visits to the canneries helped to complete the film for here the whole canning process was photographed. In the film, therefore, one may view the entire process from the capture of the fish at sea to the finished canned product. Outstanding features of the film are a scene at Smuggler's Cove showing the fishing fleet at anchor, secured after a rough and dangerous landing, and scenes showing a barge being loaded with tuna.

This new film forms a part of the free film service furnished by the Fish and Game Commission. Many splendid films showing wild birds and mammals in their own homes are available through the Fish and Game Commission's educational and publicity department.

SEVEN GRIZZLIES FORMERLY EXISTED IN CALIFORNIA.

Now that the grizzly bear is extinct in California careful studies are being made of the material at hand to find out how many varieties of grizzly bear actually existed in this state.

Dr. C. Hart Merriam has published a review of grizzlies and big brown bears of North America (U. S. Dept. Agric., North American Fauna, No. 41, Feb. 9, 1918) in which it is pointed out that seven varieties of grizzly bear were formerly found in this state. The California coast grizzly formerly ranged in humid coast regions from San Francisco Bay south to San Luis Obispo. The Tejon grizzly was found in the dry chaparral hills of interior coast ranges, between the San Joaquin Valley and Los Angeles. The Sacramento Valley grizzly was limited to the Sacramento (and perhaps San Joaquin) Valley and adjacent foothills. In extreme northern California, along the Klamath River, ranged the Klamath grizzly, while further south in Mendocino County was to be found the Mendocino grizzly. The largest one formerly occurred in the Santa Ana, Cuyamaca and Santa Rosa mountains of southern California. Still another variety roamed over the southern Sierra Nevada, this one being called the Henshaw grizzly. The Southern California grizzly was the largest of all the grizzlies, even larger than the great buffalo-killing grizzly found on the Kenai Peninsula in Alaska. It was of such a huge size that the weight of a male is estimated at 1400 pounds. The height at the shoulder from flat of foot of one specimen measured 4 feet. The sole of the largest foot, without claws, measured 12 inches in length and 8 in breadth. The length of an old female taken in Trabuco Canyon near Santa Ana measured 6 feet 3 inches.

Material collected by the United States Bureau of Biological Survey made possible this paper, which describes eighty-six different varieties of grizzly and brown bears, a large number of which are newly described varieties. Skins and skulls in the California Museum of Vertebrate Zoology at Berkeley were used in the studies made by Dr. Merriam.

WHEN ARE GREENHEADS MOST ABUNDANT?

A recent article by Aldo Leopold in the October number of *The Condor*, entitled "Differential Sex Migration of Mallards in New Mexico," brings up the mooted question as to whether female

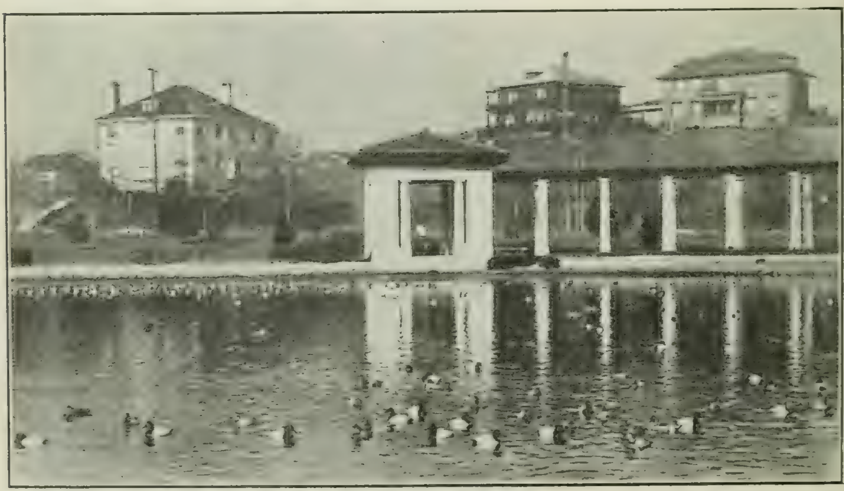

FIG. 9. Canvasbacks on Lake Merritt, Oakland, the first game refuge established in California. Photograph by H. C. Bryant, December 27, 1918.

CALIFORNIA'S GAME SANCTUARIES.

California is assuring a perpetual supply of game by setting aside areas where no hunting is allowed and where game is allowed to breed unmolested. The state is responsible for the creation of most of them, the federal government for others. Certain areas known as game refuges have been set aside by legislative enactment. Others known as state game preserves have been created by the Fish and Game Commission after the owner of the property has ceded all hunting privileges to the state for a period of not less than ten years. The federal government has set aside five bird reservations and protects all of the wild life within the national parks and national monuments. As a consequence game is now absolutely protected on nearly 3,000,000 acres within the State of California, an area roughly equivalent to three per cent of the total area of the state.

GAME REFUGES.

Name	County	Area, acres	Established
1A	Siskiyou	8,960	1917
1B	Modoc	57,000	1917
1C	Modoc	47,560	1917
1D	Trinity	64,000	1915
1E	Shasta	69,000	1917
1F	Lassen	47,580	1917
1G	Tehama	34,400	1917
1H	Plumas	31,000	1917
1I	El Dorado	64,000	1917
1J	Amador	57,600	1917
1K	Fresno	33,400	1917
1L	Tulare and Kern	37,600	1917
2A	Mendocino and Lake	37,000	1917
3A	Santa Cruz	3,400	1915
3B	San Benito and Monterey	13,760	1909
3C	Santa Barbara	39,680	1917
3D	Ventura	125,440	1917
4A	Los Angeles	600,740	1915
4B	Los Angeles		
4C	Orange	76,160	1913
4D	Riverside	69,120	1917
4E	San Diego	51,840	1917
Mount Tamalpais	Marin	28,000	1917
Lake Merritt	Alameda County (Oakland)		1869

STATE GAME PRESERVES.

No. 5	Monterey and San Benito	8,570.57	1916
No. 6	Santa Barbara	42,000	1918
No. 7	Santa Barbara		

FEDERAL BIRD RESERVATIONS.

Klamath Lake	Siskiyou	*22,400	1908
Clear Lake	Modoc	*1,600	1911
East Park	Colusa		1909
Farallon Islands	Pacific Ocean, near San Francisco		1909
Goat Island	San Francisco Bay	141	1916

*Approximate.

NATIONAL PARKS AND MONUMENTS.

Parks—			
Yosemite	Tuolumne and Mariposa	719,622	1890
Sequoia	Tulare	161,597	1890
General Grant	Fresno and Tulare	2,536	1890
Monuments—			
Lassen Volcanic	Shasta, Lassen, Plumas and Tehama	79,561	1916
Muir Woods	Marin	295	1908
*Pinnacles	San Benito	2,080	1908

*Included in State Game Refuge No. 3B.

ducks migrate southward earlier than the males. According to the article female mallards are most abundant in the Rio Grande Valley near Albuquerque during October. By November the preponderance of females is diminished and by December first there is a preponderance of males. The proportion of males and females is about equal among the mallards wintering in the region. The article furthermore points out that a number of ducks banded at Great Salt Lake in Utah have been taken in New Mexico.

It may be that sportsmen in this state can gather evidence which will support or refute the statements made.

CALIFORNIA'S FIRST GAME REFUGE.

Splendid publicity has recently been given the first game refuge established in California through the publication of an article entitled "Wild Ducks as Winter Guests in a City Park," in the National Geographic Magazine for October, 1919. The article is by Joseph Dixon, of the University of California Museum of Vertebrate Zoology, who made a careful study of the bird life on Lake Merritt, almost in the heart of the city of Oakland, and took many splendid photographs of the birds. Lake Merritt was set aside as a state game refuge in 1869, and therefore has the distinction of being the oldest refuge in the state. That the refuge is fulfilling its mission is evidenced by the great flocks of waterfowl which frequent its waters and the surrounding lawns each winter. Furthermore, the number of birds appearing is on the increase, showing that it is being utilized as a safety zone by more and more birds each year. This may in a measure be due to the systematic feeding carried on by the city of Oakland. No visit to Oakland in the winter is complete without an investigation of this bird sanctuary which so well testifies to the worthwhileness of setting aside areas where hunting is prohibited.

PROTECT THE WOOD DUCK.

Fortunately the duck most nearly exterminated in this state is one which can be readily recognized by a peculiar rolling flight quite unlike the flight of any other duck, and by a long, square tail that gives it a different outline and appearance. It possesses iridescent colors and the male has conspicuous markings. Furthermore, it practically never flocks with other ducks. There is no excuse, therefore, for killing this duck, which is protected by both state and federal laws looking towards its ultimate retention as a member of our fauna.

FISHES IN RELATION TO MOSQUITO CONTROL.

The United States Bureau of Fisheries in a recent publication (U. S. Bureau of Fisheries, Document No. 874) tells of investigations to determine the effectiveness of fishes in eradicating mosquitoes. Experiments were made with various species of small fish, and while it was found that some varieties, such as sun fish and gold fish, destroyed the mosquito when confined in small aquaria, they were of little value in large bodies of water where other food was obtainable.

However, by a series of experiments it has been found that the *Gambusia affinis* (Baird and Girard), or top minnow, can be made of practical value in the control of the mosquito pest. Investigations showed that this fish is especially suitable for antimosquito work because it seeks its food at the surface, where the mosquito and its larvæ are found; it is very prolific, giving birth to well-developed young and therefore requiring no special environment for egg culture; and it thrives in areas especially suitable for the support of mosquito larvæ. But experiment also showed that the top minnow must be protected from larger fish, bass especially, its chief protection being the presence of shallow water; and that there are some instances where the top minnow can not be used against the mosquito because the mosquito sometimes breeds in water so badly polluted that the top minnow can not live therein, as in a particular instance of water polluted by chemicals.

The results of the experiments indicate that the top minnow, when planted under proper conditions, completely eliminates mosquitoes, provided the waters are kept free from protective vegetation, such as slightly submerged leaves and stems, or growths which form a floating mass; and that even though protective vegetation exists, the top minnow greatly reduces the number of mosquitoes, the number of fish required for eradication depending largely, of course, upon the condition of the water with respect to protective vegetation.

BIRD PROTECTION IN ENGLAND.

A committee of the Royal Society for the Protection of Birds has recently investigated the present English laws and has suggested many changes looking toward the reconstruction of the Wild Bird Protection Acts. It is pointed out that there are numerous defects and obscurities in phraseology which have added largely to the complications which have arisen in the working of the six interdependent acts. The law has not been enforced in any general or habitual manner and has failed to protect the rare birds of the country.

The report gives first of all a historical review of bird protection laws in Great Britain, a digest of the present laws with the offenses and penalties, results of the present law, the proposed new law, and international law. Among the recommendations are the setting up of two schedules in the place of one, the general closed season to be from March 1 to September 1. Owners and occupiers are to have power to kill or take birds on their land during the closed season, with the exception of the birds listed in the schedules. Listed among the game birds on schedule A with an open season each year are such birds as the skua, black-throated diver, night jar, peregrine falcon, wood lark, woodpecker and wryneck. On the other hand, among the birds on schedule B which are given total protection are such birds as the avocet, Kentish plover, golden eagle, osprey, spoonbill and most of the owls.

The committee further recommends increased educational work, stating: "In order to protect birds both worker and child must know a little about them. Information regarding their characteristics and habits must be circulated. Bird and arbor schemes or their equivalent must bring light and air into the whole elementary school system. We should be glad to see a Bird Day, devoted to lectures, become a regular feature of the program of every school in this country."

THE FISHING INDUSTRY IN CALIFORNIA.

California in 1915 ranked second among the Pacific Coast states in the number of persons engaged, in the value of its investment, and in the amount and value of its fishery products. There were 4,282 persons engaged in the shore fisheries, 551 in the vessel fisheries, 35 in vessels transporting, and 3,584 persons engaged on shore in canneries, etc., making a total of 8,452 persons connected with the fisheries, as compared with 5,530 in 1904. The increase can be traced mainly to the shore industries.

The total investment in the fisheries of the state amounted to $5,824,263, showing an increase of nearly 55 per cent since 1904. The items making up this total are 73 fishing vessels valued, with their outfit, at $354,375; 20 transporting vessels with a value, including their outfit, of $72,000; 1,429 gasoline boats valued at $1,351,110; 1,169 other boats valued at $104,816; apparatus, in the shore and vessel fisheries, valued at $606,944; shore and accessory property with a value of $2,731,390 and working cash capital amounting to $448,809.

The products of the fisheries of California in 1915 aggregated 93,338,703 pounds, with a value to the fishermen of $2,506,702. This is an increase of about 44 per cent in quantity, but a decrease of about three-fifths of 1 per cent in value as compared with 1904. Among the items in the products of special importance may be mentioned 7,303,933 pounds of chinook salmon, valued at $340,949; 21,024,190 pounds of albacore, or tuna, valued at $316,103; 6,923,563 pounds of flounders, valued at $209,766; 375,774 pounds or 53,682 bushels, of eastern oysters, valued at $165,573; 4,952,692 pounds of salted cod, valued at $161,695; 1,784,488 pounds of striped bass, valued at $146,928; 4,344,254 pounds of rockfishes, valued at $146,216; 892,392 pounds of spiny lobsters, valued at $130,119; 1,414,155 pounds of crabs, valued at $124,870, and 5,761,929 pounds of sole, valued at $108,252.—*Bureau of Fisheries, Document No. 875.*

A CALIFORNIA FOX FARM.

Messrs. Lewis and Kierman, of Nevada, have started a fox farm near Pomin's, on the shores of Lake Tahoe. Six of the best silver black foxes obtainable have been purchased from Prince Edward Isle, at a cost of over $9,000. Four large fox pens of reinforced heavy poultry wire have been built, each equipped with a strong house for shelter and with runways to the ground. The accompanying picture (Fig. 10) shows the favorite male fox, a little over two years of age, which produced fourteen pups on his second breeding. This fox cost $2,100 and his fur is exceptionally fine. Messrs. Lewis and Kierman expect to raise furs for the market, and it is rumored that other parties from Nevada intend starting a fox farm in the spring, also to be located in the Tahoe region.—J. H. SANDERS.

FIG. 10. Silver gray fox. A valuable animal imported from Prince Edward Island for use at a newly established fur farm at Lake Tahoe. Photograph by J. Sanders.

HOW MANY SHOOTERS IN THE UNITED STATES TODAY?

Prior to the war it was estimated that we had at least five million sportsmen in the United States. Men in a position to know claim that this year the total will be increased at least one million and possibly more. Many of the boys who before their experience in the army had never fired a gun, will not be satisfied now without their share of the sport.—*Illinois Sportsman*, Nov. 13, 1919, p. 3.

OWNERSHIP OF WILD LIFE.

"Wild life is the property of all the people," says the *Conservationist*. No one attempts to deny this, and least of all the game violator. From his point of view it is not only the property of all the people, but is more particularly the property of him who can get it. The more remote the locality where the law is violated, the more deeply rooted is the idea that the game is there to be taken, regardless of law, and without much feeling of moral obliquity. The violator has a strange feeling that some sort of justification is on his side, though the law may be on the other. The point of view is that of early colonial times, before the state had reason to assert its ownership—when, indeed, game was the property of any one who could shoot straight enough. It is the point of view of an extreme individualist.

Game is still the property of everyone. But, whereas originally the people placed no restrictions upon the use of that property, they have now thrown about it safeguards that are vital for its continued existence. Every citizen has a vested interest in every individual bird, animal and fish, and is defrauded, if the game is taken in any way contrary to the established rules. The point of view of the man who respects the law, and insists upon respect for it in others, is that of collective ownership. His individual right to take game is dependent upon consent to do so from others.

The feeling of collective ownership is still only partly developed. The tendency to wink at violations still decreases as the sense of common ownership of wild life is strengthened.—*The Sportsmen's Review*, Nov. 15, 1919.

THE WARDEN OF GAME.

"The game protectors are the people's appointed representatives in protecting what is the people's own property. Their task is a hard one, but they are doing it well. From year to year, the force is constantly developing in efficiency and effectiveness, and its members are responsible for the conservation of natural resources of untold value. They perform work of the highest public importance and their efforts are deserving of the people's unqualified support and commendation."—*The Conservationist*, May, 1919.

MUSKRAT FARM ESTABLISHED IN OHIO.

The price of furs has continued to rise until the lowly muskrat, which our fathers sold for 10 cents a pelt, now brings about

$1.50. It is not surprising, therefore, that an enterprising man in Port Clinton, Ohio, has purchased 160 acres of marsh land along the river which he expects to turn into a muskrat fur farm. The fact that the bodies of the animals will bring about 25 cents increases the possibility that the project will be a success.

CANADA URGES PROTECTION OF GAME.

One of our two species of swans, a curlew and a crane, are in the gravest danger of extermination now and other species will follow unless everyone helps to keep our promise to protect these migratory birds. Man has exterminated species of birds; but not in all time can he replace a species. A species evolved through millions of years, with its marvelous adaptations to meet its needs, its wonderful beauty or power of flight, can be exterminated by man and disappear from this earth utterly and forever or it can be protected and live on, reproduce its kind, and be a delight and a source of knowledge to man, who may in some distant, wonderful time unravel some of the mystery of its origin which points back to the dawn of life, and to the Creator of all. —*Dept. of the Interior, Ottawa, Canada.*

NEED FOR DOE PROTECTION OBVIOUS.

A pitiful sight that ought to carry an eloquent message to every sportsman who has killed or who may be tempted to kill a doe, was met with by two hunters on October 4, 1919, in Bear River Canyon, about eight miles above Colfax, Placer County. The sportsmen came upon a doe which had the appearance of having been dead two, or perhaps three days, judging from the condition of the carcass and by the hoof tracks of the animal that had been made previous to a light rain that had fallen the day before. The deer had evidently traveled some distance, after having received a bullet in the lower bowels, before she fell.

The lingering death, due to poor marksmanship, in itself appeals to one's sympathy, aside from the fact that the law had been violated; but that is the smaller part of the real tragedy of that lone mountain wood. The doe was a mother, and surrounding her remains were the tiny tracks of her fawn. The doe's bag still contained milk, and the udders were pink, as though the fawn had nursed, or attempted to do so, up to or after the mother had died.

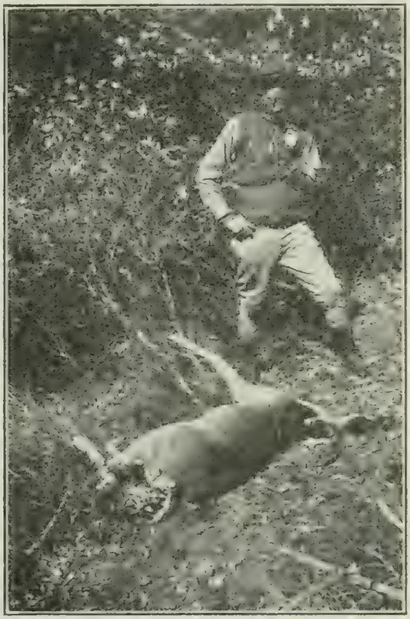

FIG. 11. A reason for the protection of does. Doe, mother of a fawn, killed by law violator. Photograph by E. M. Muse.

What became of the little fawn? Like many others that have been orphaned under similar conditions, it perhaps remained beside its unresponsive mother until it fell an easy prey to coyotes; for, not far away from the dead doe, on the dry sand bar at the edge of the river, were the unmistakable stubby-toed dog-like tracks of a large coyote.

It is to be hoped that such instances as this will serve to carry a story home to that brand of *imitation* sportsmen who shoot without care or conscience.—EDWARD M. MUSE, Sacramento, California.

FACTS OF CURRENT INTEREST.

Several San Pedro canneries are paying $155 cash per ton for albacore. Five years ago this variety of fish sold at $40 a ton. In 1918 it was $60 to $90 a ton. Now the fisherman receives $155 per ton. Previous to 1910 albacore could not be given away and tons upon tons were carried to sea to feed the sharks.

* * *

Owing to the federal law prohibiting the sale of waterfowl and owing to the aggressive enforcement of the federal migratory bird law, very few illegal shipments of ducks have entered San Francisco during the present open season.

* * *

Striped bass fishermen report splendid fishing in the San Francisco Bay region, but the take by commercial fishermen has been below normal.

* * *

The Red River Lumber Company recently pleaded guilty to a violation of the water pollution laws and paid a fine of $200. The company has taken proper means to prevent further sawdust pollution.

* * *

The Fish and Game Commission has ordered a new patrol boat for use in patroling San Francisco Bay and vicinity. The boat will be thirty-one-foot over all with seven-foot beam equipped with a twelve-horsepower engine, and will be seaworthy in every respect.

* * *

Signs that the sardine industry is growing are evident in the recent canning operations of F. E. Booth and Company, at Pittsburg. Sardines caught outside the heads at San Francisco are being canned at the Pittsburg cannery. Although subject to some delay in reaching the cannery, they are said to arrive in splendid condition.

* * *

The establishment of a fur farm at Lake Tahoe and the proposed establishment of another in the same vicinity forecasts the beginning of the fur farming industry in California.

* * *

During the months of October and November, 1919, Deputy John Burke and Special Deputy Herbert Leahy made 57 arrests in San Mateo County, the fines totaling in all $1,210; 38 of these arrests, with fines amounting to $810, were made by Deputy John Burke, and 19 arrests with fines amounting to $400 by Special Deputy Herbert Leahy.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

MANY FISHING BOATS DESTROYED.

For the second time in recent years great damage has been done to the fishing fleet at Monterey because of the lack of proper shelter for the fishing fleet. On Thanksgiving Day, 1919, ninety-two power boats were washed ashore at Monterey. Nor does this include lighters, nets and other gear, and damage done to docks and wharves. The estimated loss to the fishermen alone will run close to $150,000. A further severe loss will be suffered by the canners, as sardines are plentiful at this time and there will be but a few boats to fish for them.

In England and other European countries the government improves small harbors purposely for the use of fishing smacks. It is apparent that our own government in making surveys and plans for the improvement of harbors should take into consideration the need for refuges for fishing fleets. A breakwater which would give proper shelter for the fishing fleet at Monterey is needed, and there are many small bays along our coast which should be improved and made into harbors for fishermen's boats.

FISHERMEN'S UNION AT FORT BRAGG.

During the spring of 1919 the Fishermen's Union at Fort Bragg established and operated their own plant for mild curing the salmon catch. Steep hillside property on the Noyo River was purchased and a 60 by 80-foot shed erected. It was necessary to grade about 800 feet of roadway on the steep hillside to connect the shed with the highway. The construction and grading work was done by the fishermen, most of the labor being donated. By agreement, Small & Urie canned the small salmon for the Union, the Union packing over half the total catch of nearly 3,000,000 pounds, so that

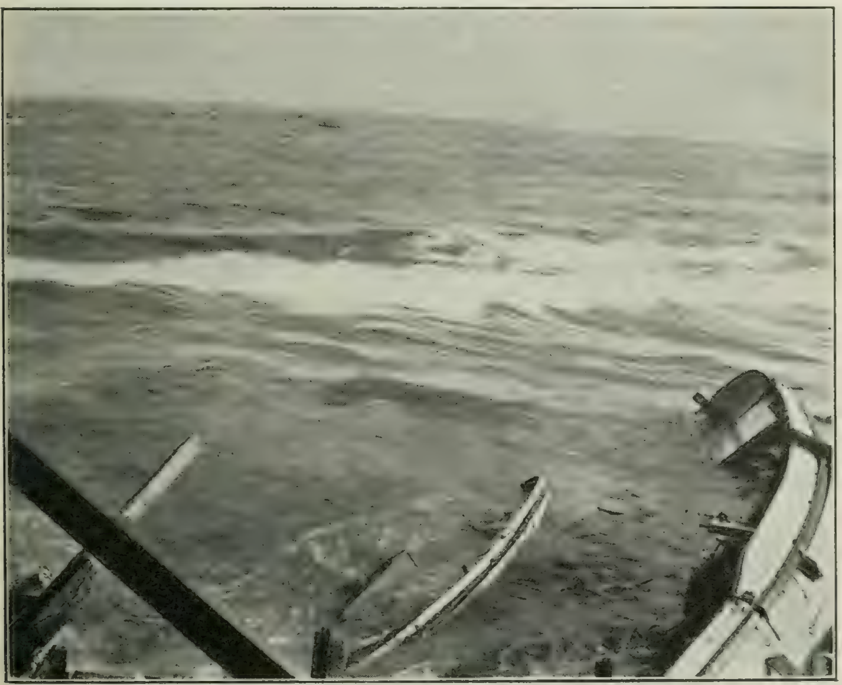

FIG. 12. Monterey fishing fleet piled on the shore after a severe storm on the day before Thanksgiving, 1919. Photograph by Heidrick.

the season at Fort Bragg has been unusually successful compared with other coast points.

Encouraged by this season's success, the Union has completed plans for next year at Fort Bragg which include an addition to the Noyo River shed to accommodate a two-line cannery, ice plant and cold storage plant and the building of a mild curing house at Shelter Cove. The proposed cannery will not only handle the small salmon but also pack sardines, which are plentiful in the Fort Bragg and Shelter Cove region.

NEWPORT BAY FISHERIES BEING DEVELOPED.

With work progressing on the breakwater at Newport Bay, Newport bids fair to become one of the important fish shipping points in Southern California. The residents of Newport and Balboa are united in an effort to develop their fisheries asset to the utmost. Already a fish packing plant is under construction and a substantial bulkhead has been built for the accommodation of boats and markets.

Newport is one of the principal smelt shipping points in California, a normal day's shipment consisting of from four to twelve tons of these fish. With the improvement work now under way the scope of the fisheries at Newport will be enlarged greatly. Already a number of fishing boats are planning on making Newport Bay their home port.—C. S. B.

FISHING VILLAGE COMPELLED TO MOVE.

The Pacific Electric Railway Company has served notices on the fishermen and other residents of Port Los Angeles ordering them to vacate their premises on or before January 1, 1920, and already the removal of this picturesque fishing village is under way. The above company has also filed a petition with the State Railroad Commission asking permission to abandon service to Port Los Angeles. It is claimed the wharf is in a rickety condition and that traffic does not justify continued service to this point. It is planned to remove the wharf at once if permission is granted.

The village at Port Los Angeles was established in 1905 by H. Sano and Dick Tododie, two fishermen, and at one time contained approximately two hundred men, women and children dependent upon the fishing business. As high as ten thousand pounds of fish has been unloaded at the wharf in one day by fishing boats operating off Port Los Angeles; but with the development of the fishing industry at San Pedro most of the fishing boats left for the latter port. As a result the amount of fish received over the wharf has decreased until today a normal day's shipment from Port Los Angeles consists only of approximately fifteen hundred pounds. There are still about sixty Japanese and Russian fishermen engaged in fishing at Port Los Angeles and all of them are planning on moving to other points in the near future.

The wharf at Port Los Angeles was constructed twenty-eight years ago by certain interests who planned on making this point the port of entry to Los Angeles. When built it was over five thousand feet long, but damage by storms four years ago caused the removal of about two thousand feet of the pier. It has always been one of the popular piers for anglers who still refer to it as "Long Wharf." During the runs of mackerel, corbina and

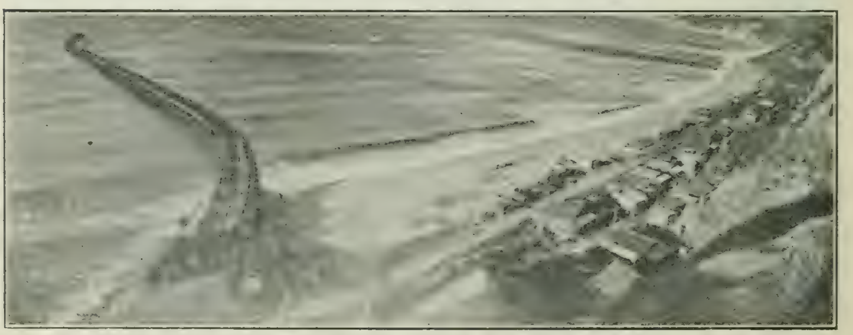

FIG. 13. Wharf and picturesque fishing village at Port Los Angeles, which is being moved by order of the owners of the land. Photograph by C. S. Bauder.

pompano, approximately four hundred rod and reel sportsmen could be counted fishing from the wharf.—C. S. B.

SEAPLANES TO LOCATE FISH.

It has generally been known for many years that many sea birds are dependent on their eyesight to locate their food while flying over the water. So what is more natural than for seaplanes to locate schools of fish in the same manner? Needless to say the fish canners of San Diego, who have been somewhat alarmed at the continued absence of sardines which have been appearing in large numbers elsewhere on the Pacific Coast, rejoiced at the suggestion of this idea.

Definite arrangements have now been made with Lieutenant Lincoln, the naval commandant in charge of operations at the Naval Air Station at San Diego, whereby regular seaplane flights will be undertaken by the navy aviators to look for schools of fish. The first flight will take place on December 15 and they will continue to patrol each day any certain portion of the sea that is desired by the canners.

When a seaplane sights a school of fish it will wire back to Rockwell Field from where the information will be telephoned to the Fish and Game Commission office at San Diego for distribution to the several canneries. A submarine chaser always hovers in the vicinity of a flying plane so as to be near in case of an accident. So it may be that the news can be sent to the nearby fishermen the quicker by means of the wireless on these boats.

While these flights may not be of so much value in winter because of the roughness of the weather, they will later on prove of much material benefit to all parties concerned when the larger fish are running. They will also settle the fact of whether certain schools of fish are running in those portions of the ocean further out than the present small fishing boats go, as the seaplanes have a four hundred mile radius of operation. It may thus be the beginning of continued prosperity to all canners and fishermen in this section as well as of aid in the investigation work of the Fish and Game Commission by showing routes, locations, and migrations of different fishes.—L. H. H.

AGAR-AGAR TO BE MANUFACTURED IN SOUTHERN CALIFORNIA.

After two years of diligent research, Mr. C. Matsuoka of Los Angeles has effected an improved process for converting several species of the common marine algæ found on the Southern California coast into agar-agar, and plans are under way for the construction of a thirty-thousand dollar plant at Tropico, California, where this product will be manufactured on a commercial scale. When completed this plant will have a capacity of approximately one ton of dried seaweed per day, and its operation will mark the beginning of a new industry in the United States. Experiments which have been carried on by Mr. Matsuoka demonstrate that agar-agar of a much superior quality to the imported article can be produced from our native seaweeds.

There are approximately fifteen species of marine algæ found on the California coast which may be used in the manufacture of agar-agar. Among the varieties found in sufficient quantities for commercial uses are: *Gelidium corneum*, *Geledium cartilagineum*, *Gracellaria confervoides*, *Euchema spinosium*, and various species of *Tenax* and *Gigartenecæ*.

Practically all of the world's supply of agar-agar is produced in China, Japan, Ceylon, and Malaysia. During the year 1919 there were two hundred and forty tons of agar-agar shipped to the United States from Japan where the manufacture of this product has reached the proportions of an important and well established industry. In the latter country only ten species of seaweeds are found which are used in its manufacture.

It is prepared for the market in two ways. One method consists in drying and bleaching the thallus of the algæ in the sun. The other method consists in making a jelly of the seaweeds, allowing the water to freeze out and cutting the residue into thin strips and drying thoroughly. The American Agar Company intends to use the latter method.

Agar-agar is one of the most useful products obtained from seaweeds. It is used in the manufacture of vegetable isinglass, capsules, candy, paints, and culture media for bacteriological research. During the European war it was successfully employed in the treatment of war wounds. It is supplied to the drug trade commercially in dry, transparent crystals that are reduced to a coarse powder for medicinal use. It has the natural property of absorbing water and retaining it; and in medicine, the additional property of resisting the action of intestinal bacteria and of the digestive enzymes. It is prepared by boiling and may be eaten with milk or cream, or mixed with any of the ordinary cereal foods with the addition of salt or sugar.—C. S. BAUDFR.

NOTES FROM THE STATE FISHERIES LABORATORY.*

By WILL F. THOMPSON and ELMER HIGGINS.

THE INAUGURATION OF SCIENTIFIC WORK ON THE SARDINE.

The past quarter has seen the inauguration of a definite program of investigation of the sardine. This species has become the most important to our commercial fisheries, and it is necessary that we learn something concerning its habits and that we have as detailed a knowledge as possible of the course of the fishery. A resume of the program will be found in another part of this magazine (p. 10).

In order that desired results may be obtained, Mr. O. E. Sette, formerly stationed in Long Beach as collector, has been transferred to Monterey, where he will observe the sardine run throughout its season, under the direction of Mr. Thompson.

To date (November 28), the sardine run in Southern California has not really begun, only very small fish being in evidence. The shortage in cans has, however, been the only hampering factor at Monterey.

SOME RECENT FISHERY PUBLICATIONS.

A publication of the United States National Museum has recently appeared, describing the guano birds of Peru. As Dr. R. E. Coker, the author, states, "Peruvian guano is indirectly but obviously a product of fish. The birds in this case fulfill a function comparable to that of the American factories that convert fish into fertilizer." He also says "a quantity of more than 10,000,000 tons of high grade guano is reported to have been extracted from the Chincha Islands between 1851 and 1872." The pictures accompanying the report are remarkable, showing the great numbers of birds on the nesting places. The paper should be of great interest both to those interested in birds and those interested in fish.**

Dr. R. E. Coker has also another recent publication to which attention may be called, namely that on the "Fresh-water Mussels and Mussel Industries of the United States." These mussels are used for button-making in an extensive industry. The bulletin deals with phases of the industry and describes the species, although it does not review the excellent work which has been done in recent years on the strange life history of these mussels, for the most part by employees of the Bureau of Fisheries.†—W. F. T.

A SNIPE-FISH FROM CATALINA.

The president of the Tuna Club of Catalina Island, Mr. J. A. Coxe, gave the undersigned a very small fish, with a long snout, which he said had been picked up on the beach at Avalon. This fish proved to be identical with the *Macrorhamphosus hawaiiensis* described by Dr. C. H. Gilbert from near Laysan Island, as taken by the United States Bureau of Fisheries steamer "Albatross." A figure of this species may be seen in Volume 23, Part 2, of the Bulletin of the United States Bureau of Fisheries. According to a recent review of the species of the family, the form found in the Hawaiian Islands is the same as a species taken in East Africa, the Indian Ocean, China, and the Mediterranean, namely *Macrorhamphosus velitaris* Pallas.‡

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*California State Fisheries Laboratory, Contribution No. 16.

**Habits and Economic Relations of the Guano Birds of Peru, by R. E. Coker. Proceedings of the United States National Museum, Vol. 56, pages 449-911. Plates 53-69. Document No. 2298.

†Fresh Water Mussels and Mussel Industries of the United States, by R. E. Coker. Bulletin of the Bureau of Fisheries, Vol. 36. Document No. 865.

If this is true, the species is very widespread indeed. The writer has not had the opportunity of comparing specimens from these various localities, hence it is not possible to state positively that this species is in reality the somewhat cosmopolitan one mentioned above. That from Catalina was compared directly with the type of *Macrorhamphosus hawaiiensis.* This is a new and most interesting record for our Pacific Coast, this form not being an active swimmer as most recently found "visitors" are.—W. F. T.

THE "RUNNER" FISH IN LOWER CALIFORNIA.

Mr. Gilbert Van Camp of the Van Camp Sea Food Company has in his possession a mounted specimen of the "Runner" of tropical seas, *Elagatis bipinnulatus* (Quoy and Gaimard). It was taken at Cape San Lucas, Lower California, during the spring months of 1919, while its owner was engaged in operating a cannery in Lower California.

This is, in so far as the writer is aware, the sole record of this species from the western coast of North America, although known from the East Indies, the West Indies, Hawaii, India, and occasionally north as far as Long Island on the eastern coast of the United States.

The species may obviously be expected some time to put in an appearance on the coast of Southern California. It is one of those species commonly supposed to be widely distributed, although specimens from different regions have not been closely compared to make the fact certain.

It is to be recognized by the long dorsal and anal fins and by the presence behind each of a detached finlet containing two rays. It belongs to the same family of fishes as does our common yellow-tail (*Seriola*), namely the Carangidæ.—W. F. T.

THE OCCURRENCE OF THE JAPANESE HERRING.

In California Fish and Game for April, 1918, page 4, Professor Starks of Stanford University, in reviewing the herrings and herring-like fishes of California, briefly describes and gives an illustration of the Japanese herring, *Etrumeus microps.* He says in part: "The Japanese herring is a common species in the Hawaiian Islands and in Japan. Specimens have been taken at San Diego, and a few years ago two specimens were sent to Stanford University from that locality with the statement that it was not rare in certain seasons. It should be looked for and its appearance and abundance reported to the State Fish and Game Commission."

A specimen of this species was taken with the sardines caught November 3, 1919, by the boat "Maru," near San Pedro, according to Mr. E. M. Nielsen of the San Pedro office of the Commission. The specimen was forwarded to the laboratory and proved to be the Japanese herring. It resembles the sardine closely enough to be difficult to distinguish, and its appearance may be frequent despite its apparent rarity.—W. F. T.

DEEP SEA "MONSTER" CAPTURED.

Among the strange fishes taken in the fine-meshed nets used on the boat "Albacore" for the collection of young fish, there is none more bizarre in appearance than the great-mouthed ferocious looking little monster, *Idiacanthus antrostomus,* Gilbert. This fish is about three inches long, jet black in color, and of slender worm-like form. A row of luminous spots are placed on each side, supposedly supplying light, for at the depth normally inhabited by this fish, there is little light. The head is large, the eyes small, and the mouth enormous, bristling with fang-like teeth of assorted sizes.

This species has only been recorded by Dr. Gilbert in 1890 as taken off Catalina Island at a depth of 603 fathoms. Our specimens were taken May 6, 1919, at night in but 20 fathoms, one near Catalina and one about 90 miles off shore, near Cortez Bank. Other closely related species have been taken, one in the mid-Atlantic from a depth of 2750 fathoms, and one from off the Chilean coast from 677 fathoms.—E. H.

MEXICAN FISHES IN CALIFORNIA PORTS.

One of the finest food fishes to come into Southern California ports during the last season was the Spanish mackerel,

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‡See Regan Annals and Magazine of Natural History, (8) 13, p. 17.

Scomberomerus sierra, which was brought to San Diego from Mexico during October in considerable quantity. These fish are rarely taken as far north as San Diego, but are said by fishermen to be plentiful on the Mexican coast, a considerable distance north of Cerros Island.

Two beautiful specimens sent us by Mr. Helwig of the San Diego office of the Commission, are of interest because of the arrangement and number of orange spots on the sides of the fish, which are more numerous than in any description of the species, and are arranged in about 18 or 20 diagonal rows.

Mr. Neilsen, statistical assistant at San Pedro, informs us that a cargo of these fish was also brought to that port during the summer.—E. H.

FIRST APPEARANCE OF THE "CRESTED BAND-FISH."

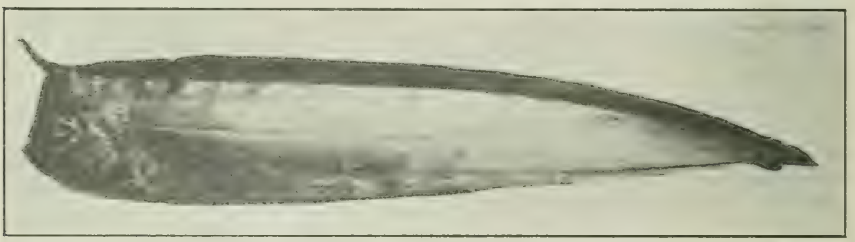

FIG. 14. Crested band-fish. *Lophotes cepediaris*? Taken in the surf at Long Beach, California, July 25, 1919. Photograph by V. E. Pearl.

On July 25, 1919, a rare and beautiful fish was brought to the laboratory, of so strange a form that it proved quite a curiosity to fishermen and others. The specimen was found to be a species of *Lophotes*, probably *L. cepedianus*, Giorna, the "crested band-fish." The fish was found swimming feebly in the breakers at Long Beach and was caught by a couple of passers-by who waded into the surf and seized it in their hands. It was taken to a photographer by Mr. V. E. Pearl, where the accompanying photograph (Fig. 14) was made, and the fish was then given to us.

The fish is long and much compressed, being about four feet long, eight inches deep, and only one and three-eighths inches wide. The skin is smooth, without scales, except for a single row against the dorsal fin, and of a bright silvery color with purplish tints on the head. The eye is large and placed low; the mouth is small and armed with many small bristle-like teeth; the fins are bright red, the dorsal extending from the head to the tail. The first ray of the dorsal fin is produced, forming a high crest about eighteen inches long. Unfortunately it was broken in making the capture, but was said to bear several membranous streamers which were red like the fins.

This is the first specimen which has fallen into the hands of naturalists in America. Indeed, probably not more than a dozen specimens have ever been taken, and its rarity makes its occurrence in California well worthy of note. The species was first described by Professor Giorna, of the Academy of Turin, in 1803. Like many other pelagic fishes, it is evidently very widely distributed. It has been taken at various other places in the Mediterranean, at the Cape of Good Hope, and in New Zealand. Single specimens of the same or very closely related species have also been taken near the Madeira Islands and in Japan. None of the specimens have been taken in the fish's natural habitat which is said to be moderate depths in the open sea, but all have been cast ashore in a greatly enfeebled or damaged condition.

Several species of *Lophotes* have been described but the material for study has been so slight—a single specimen in most cases—that it is entirely doubtful whether more than one or two species exist. Our specimen differs in some respects from the current descriptions of any of the supposed species, but it seems likely that it belongs to the first named, *L. cepedianus* of Giorna. Nor is the relationship of the family well understood. Dr. Jordan, in his "Guide to the Study of Fishes," remarks, "It is thought that the *Lophotidæ* may be related to the ribbon fishes, *Taeniosomi*, but on the whole they seem nearer the highly modified *Scombroidei*, the *Pteraclidæ*, for example." Thus our fish is placed in the group of mackerel-like fishes which contains such peculiar forms as the pomfret, the dolphin fish, the luvar, and the square-tail—all previously recorded in CALIFORNIA FISH AND GAME.—E. H.

CONSERVATION IN OTHER STATES.

NEW YORK ENFORCES CONSERVATION LAWS.

In a recent New York case a violator of the game laws was held in $1,000 bail and later paid a $500 fine. The fact that nothing but the highest commendation, because of the amount of these sums, has been expressed by the newspapers, is an indication of the growing determination of the public to support the conservation laws. There was a time when case after case of this character was thrown out of court, or sentence suspended, largely, it would seem, from lack of a full comprehension of the basic principles underlying the conservation law; but the striking contrast of recent cases disposed of shows that all over the land there is an awakening interest in game conservation and a determination to see that the game laws are enforced.—*The Conservationist*, Vol. 2, p. 94.

PROTECTION OF SOCKEYE SALMON.

There was signed at Washington on September 2, 1919, a treaty between the United States and Great Britain, having for its object the protection and rehabilitation of the sockeye salmon in the contiguous waters of the State of Washington and the Province of British Columbia. The protection accorded the salmon under this treaty is such as was determined to be necessary by the International Fisheries Conference which held hearings in Washington and British Columbia in 1918.

MINNESOTA AUCTIONS CONFISCATED GEAR.

The official bulletin of the Minnesota Game and Fish Department shows a photograph of a part of the accumulated paraphernalia confiscated during the past three years. The picture shows nets and traps of all kinds and a row of more than a hundred and fifty guns and rifles. The property was disposed of at public auction on August 1 and 2, 1919, the net proceeds accruing from the sale amounting to $2,592.70.

VIRGINIA FAVORS NEW TYPE OF REFUGE.

Instead of setting aside well stocked areas as game refuges, the State of Virginia is planning some game preserves. Owners of tracts from 200 to 400 acres in each of the 400 odd magisterial districts are being sought who will bequeath to the commonwealth exclusive shooting privileges on such tracts. The state will then post the areas and plant thereon mated pairs of quail, which the state will secure from Texas. The quail are to be fed for the first few weeks, but no attempt will be made to keep them within the preserve, on the theory that if they are hunted outside the preserve they will speedily learn the places where they are not disturbed.

MINNESOTA BREAKS RECORD.

During the year 1918 the Minnesota Fish and Game Commission reared 333,792,127 fry and fingerlings. This breaks all records for the state, the output having been about tripled since 1911.

CANADA ISSUES EDUCATIONAL FILMS.

The Ontario government has recently organized the Ontario Motion Picture Bureau for the express purpose of issuing propaganda by means of films. The Bureau now has 200 films, covering 82 different subjects, which are appearing before large audiences throughout Ontario. Of particular interest are two films entitled "Fish as Food" and "Ontario Fisheries." More and more are fish and game resources being advertised by means of films.

LIFE HISTORY NOTES.

FOREST FIRES DESTROY GAME.

The forest fires in the Angeles National Forest during the fall of 1919 were very destructive to game of all kinds. The burned area covers over two hundred thousand acres of the forested canyons and ridges and brush covered hillsides (see Fig. 15).

The carcasses of deer have been found by fire fighters in many places. Gray squirrels and mountain quail have suffered severely.

I have just made a survey of conditions in Pacoima Canyon, and the Little Tujunga and Big Tujunga canyons. In the first two, which are outside of, but adjoining the Game Refuge, I saw numbers of dead rabbits, squirrels and mountain quail. Big Tujunga escaped total destruction, as the flames did not cross to the east side.

No doubt most of the game escaped death by flame and smoke, but the destruction of food will lead to widespread famine later. Fanned by a high wind that blew from the desert side toward the sea, the flames in places swept away every bit of vegetation. The game had no choice but to flee before the flames, toward the foothills, near the towns of San Fernando, Sunland, Monte Vista, Pasadena and Azusa, where they sought shelter in vain, because the fire swept widely, over the entire brush covered hills of the south slopes of the Sierra Madre Mountains.

It was pitiful to see dozens of mountain quail, gathered around a little pool of water in a canyon, their feathers burned and topknots gone. In dozens of places I came across similar groups.

The greatest menace to game comes from the destruction of food. At this time the seeds had all ripened, and the walnuts, pine nuts, acorns and manzanitas were ready to eat. These have been burned over a wide expanse, and the coming on of winter will make it hard for game to exist.

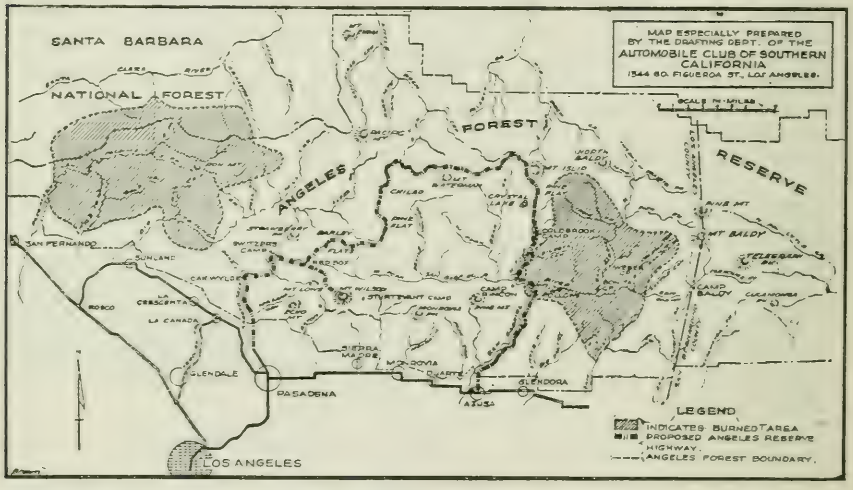

FIG. 15. Map of Angeles National Forest area destroyed by devastating forest fires during the fall of 1919. Severe injury to game was the natural result.

The recent rains in Southern California fell at a very opportune time, and so gently as not to cause any erosion. Three weeks after the rain the burnt over hillsides were becoming green.

A feature of the destruction of covers for game must not be forgotten. Rabbits and quail, I found, are massing on patches of unburned territory. Overcrowding will result, and hunters will find it easy to kill most of the game in such places. A rancher at the mouth of the Little Tujunga told me that hunters had killed sixty-eight rabbits in a forty-acre field in a couple of hours on the Sunday after the fire, and seventy-eight the following Sunday.

There is a bright side to the picture: a great deal of food was spared in creek beds. A large crop of quail had been raised and enough will be spared for breeding next season, and the early rains have already sprouted the grass and weeds. The game will be restored in time, but nature lovers and sportsmen should work together to prevent a repetition of these fires by enlisting government, state and county aid, building roads and fire breaks and check dams in the mountains, and reforesting the burnt areas.—**CHARLES G. STIVERS, M.D.**, Los Angeles, California.

DOE WITH THREE FAWNS.

During the latter part of August, the writer ran across a doe with three fawns in the lava bed section of the Modoc National Forest. I was able to come quite close to the animals, which showed little signs of fear. I am quite positive that there were no other deer in that immediate vicinity at that time, as I had been fighting fire close by and had been all around the place where I saw the doe and fawns. I thought it unusual to see a doe with three fawns, especially as the little fellows ranged themselves alongside the doe as if they were perfectly at home and belonged there. I stood looking at the three of them and they at me at a distance of not more than thirty feet for about a minute, the old doe stamping her foot at me; then they trotted off leisurely into the brush.—**WM. S. BROWN**, Alturas, California.

WILD CAT EATS CHICKENS.

I recently opened up two wild cats (*Lynx eremicus californicus*) to see what they had been eating. In the stomach of one I found the remains of two small Plymouth Rock chickens which must have been caught at least five miles from where the cat was killed, and in the other the remains of three mountain quail.—**D. W. MAXEY**, Gorman, California.

FOOD OF THE BOBCAT.

The wild cat (*Lynx eremicus californicus*) is still found in numbers here, as indicated by the number being trapped in the Monterey district of the Santa Barbara National Forest. Wild cats feed on the smaller game animals and birds. I watched one of these animals in his attempts to secure a breakfast last summer. He stole up on a covey of mountain quail, and as he flushed them, got two. I have found feathers of both mountain and valley quail, which investigation proved were left from a feast by wild cats.—**H. H. HUNT.**

SOUP-FIN SHARK EATS ABALONE.

In July of last year I was fishing for sharks off the bridge at Ocean Beach when the last shark I caught used my last bait (a small perch). I operated on the shark in an effort to retrieve my bait and was surprised to find an abalone out of the shell and apparently still alive, as it seemed to still have muscular action. Anyway I am positive it was taken out of the shell alive and I wondered how the shark accomplished it. The shark in question was a little over six feet long, weighed I judged about 120 pounds, and is what we call sand shark or soup-fin shark (*Galeorhinus zyopterus*).—**A. R. MILLER**, East San Diego, California.

DOES THE BARROW GOLDEN-EYE BREED IN THE SIERRAS?

The Barrow golden-eye (*Clangula islandica*) is a rare duck in California, there being less than a dozen records for the state. Furthermore, these records show it to be a winter visitant which occurs almost entirely in the central part of the state. However, this duck being a common breeder in the Rocky Mountain district, and having been found breeding in Oregon and Washington, it would seem possible that it might also breed around the higher Sierran lakes. Evidence that this is doubtless true was obtained this past summer. While on a pack trip from Tahoe to Yosemite, Smedberg Lake, in the northern part of the Yosemite National Park, was visited on August 25, 1919. On the lake were a pair of golden-eyes and six young. The adult birds were closely approached, making identification easy. In that no thought was given to the possibility of these golden-eyes being of the rarer species, no attempt was made to ascertain the shape of the white spot between the eye and the bill. However, as it is very unlikely that the American golden-eye would be found in such a situation during the summer season, it seems reasonable to record the occurrence of the Barrow golden-eye at the above time and place, thus establishing the first record of summer occurrence.—H. C. BRYANT, Berkeley, California.

MEADOWLARKS CONTROL CRICKET PEST.

The State of Washington, with the aid of agents of the United States Department of Agriculture, has been attempting to control the coulee cricket, which devastates large areas in the vicinity of Adrian, Washington. According to Mr. Max Reeher, scientific assistant in the United States Bureau of Entomology, western meadowlarks appeared in great numbers in the Dry Coulee last fall and began eating the newly hatched crickets. So efficient were these birds in controlling the situation that arrangements for a 1919 control campaign were abandoned. The meadowlarks were almost entirely responsible for the complete cleanup of the area.—A. C. BURRILL, Forest Grove, Oregon.

REPORTS

SEIZURES—FISH, GAME AND ILLEGALLY USED FISHING APPARATUS.

July 1 to September 30, 1919.

Game.

Deer meat	1,424	pounds
Quail	10	
Ducks	63	
Pigeon	4	
Rabbits	51	
Deer hides	8	
Miscellaneous birds	19	

Fish.

Striped bass	1,321¾	pounds
Black bass	22	pounds
Halibut	5,890	pounds
Catfish	45	pounds
Whitefish	15	pounds
Trout	70	pounds
Salmon	292	pounds
Perch	7	pounds
Barracuda	250	pounds
Crabs	267	
Lobsters	127	
Clams	457	
Clams	675	pounds
Dried shrimps	3,500	pounds
Abalones (dried)	150	cases
Abalones	47	
Nets (illegal)	2	

Searches.

Illegal fish and game	13

CALIFORNIA FRESH FISHERY PRODUCTS—COMPILED BY DEPARTMENT OF COMMERCIAL FISHERIES.

JULY, AUGUST, SEPTEMBER, 1919.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Sutter	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Albacore												10,175,162	126	2,048,882	12,224,170	
Anchovy								18,070		339,675		21,365		21,670	400,780	
Barracuda								775	2,458	21,087	56,756	616,964	13,714	174,366	1,189,120	127,569
Bluefish									7,728	15,283					23,011	
Bocaccio		80	117,900					32,840	1,515	314,596					466,931	
Bonito										22	18,672	1,331,102	581	156,033	1,506,410	9,568
Carp				225	26,184		1,453	806							28,668	
Catfish				5,323	765		4,018	708							10,814	
Chilipepper								79,061	337						79,398	
Coalfish								176,147	2,762	1,586					180,495	
Cultus cod	6,137	51,679						143,223	18,693	9,860		205			230,097	
Dogfish			308				563	6,320	160	1,050		19,380		205,672	233,756	
Dolphin																
Eels																
Flounder								81,217	79	1,068	2,996	4,192	251		89,806	
Greenfish																
Hake								39,480	1,309	238		699		665	42,391	
Halibut	12,868	81,915	343					3,006	653	13,012	74,557	120,476	14,917	116,451	438,298	898,914
Hardhead																
Herring																
Kingfish								3,910	16,604	14,812	38	19,458	40	401	49,266	
Mackerel	180								1,199	91,493	11,956	585,410	11,091	70,523	771,855	4,105
Martin																
Mullet														109	109	
Perch	143		132				25	3,245	936	1,329		3,417	221	8,169	17,617	
Pike				48			67								115	
Pompano								16	342			1,769		31	2,158	
Rock bass											571	66,152	4,776	113,661	185,160	
Rock fish	7,456	499						248,588	48,757	112,128	11,008	108,965	735	33,373	571,509	6,190
Salmon	505,957	2,489,190	1,884	1,346,809	197,172		1,491,849	1,364,576	14,925	86,091		10			7,501,763	

Sanddab	----	----	----	----	----	----	----	98,277	29,519	971	1,211	1,265	----	1,170	132,413	----
Sardine	----	----	141,700	----	----	----	----	7,855	2,041,604	31,237,336	54	432,541	25	1,407,669	35,268,784	----
Sculpin	----	----	----	----	----	----	----	----	----	----	----	7,946	540	----	8,486	----
Sea bass (black)	----	----	----	----	----	----	----	----	----	----	2,555	19,129	859	19,406	41,949	10,175
Sea bass (white)	124	----	12,430	----	----	----	----	5,411	291,083	12,205	22,018	828,112	2,259	63,482	1,237,124	36,490
Sea trout	47	----	----	----	----	----	----	----	----	----	----	7,218	----	2,698	9,963	----
Shad	----	----	----	1,109	1,003	----	1,713	----	----	----	----	----	----	----	3,825	----
Shad (buck)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Shad (roe)	----	----	----	45	----	----	----	----	----	----	----	----	----	----	45	----
Sheepshead	----	----	----	----	----	----	----	----	----	----	----	168	842	218	1,228	----
Skate	----	----	----	----	----	----	----	13,445	----	----	393	272	----	----	14,110	----
Skipjack	----	----	----	----	----	----	----	----	1,650	1,343	----	3,835,093	----	2,440,398	6,278,484	----
Smelt	6,849	----	27,902	----	----	----	----	27,527	20,528	72,492	2,707	7,517	9,241	1,399	176,162	----
Sole	936	----	----	----	----	----	----	1,232,301	81,463	8,593	11,336	9,792	----	----	1,344,421	----
Split tail	----	----	----	----	----	----	480	----	----	----	----	----	----	----	480	----
Striped bass	----	----	----	12,952	1,539	----	67,421	33,476	----	956	----	----	----	----	116,344	----
Stingaree	----	----	38,200	----	----	----	----	----	----	----	----	----	----	----	38,200	----
Suckers	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Surf fish	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Swordfish	----	----	----	----	----	----	----	----	----	----	----	17,900	----	352	18,252	----
Tomcod	----	----	----	----	----	----	----	4,515	----	----	----	----	----	----	4,515	----
Trout (steelhead)	17,162	----	----	----	----	----	----	----	----	----	----	----	----	----	17,162	----
Tuna	----	----	----	----	----	----	----	----	----	----	17	1,640,642	854	121,144	1,762,657	48,482
Tuna (blue fin)	----	----	----	----	----	----	----	----	----	----	----	13,292,406	----	38,398	13,330,804	----
Tuna (yellow fin)	----	----	----	----	----	----	----	----	----	----	----	345,862	----	58	345,920	----
Turbot	----	----	----	----	----	----	----	280	----	----	----	----	----	----	280	----
Whitebait	----	----	----	----	----	----	----	1,073	----	----	----	----	----	----	1,073	----
Yellowtail	----	----	----	----	----	----	----	----	----	----	----	409,988	3,881	1,539,322	1,953,191	6,933
Miscellaneous	----	----	----	----	----	----	21	14,402	2,222	1,976	11,019	47,511	1,092	4,464	82,707	855
Total fish	558,159	2,623,693	310,799	1,366,511	226,663	----	1,570,613	3,640,550	2,583,836	32,356,232	227,864	33,981,388	66,081	8,890,187	88,432,576	1,149,281
Crustaceans—																
Crab (doz.)	287	----	----	----	----	----	----	1,558	22	26	----	----	----	----	1,893	----
Ecrevisse (doz.)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Shrimp	----	----	----	----	----	----	----	271,054	----	----	----	----	----	----	271,054	----
Spiny lobster	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	157,520
Mollusks—																
Abalones	----	----	----	----	----	----	----	----	515	32,739	298,255	----	----	----	331,509	----
Clam (cockle)	----	----	1,225	----	----	----	----	----	----	----	----	----	830	----	2,055	----
Clam (mixed)	4,049	912	6,039	----	----	----	----	171	----	----	----	----	----	----	11,171	----
Clam (Pismo)	----	----	----	----	----	----	----	----	100	----	108,664	----	----	----	108,764	----
Clam (soft shell)	----	732	1,260	----	----	----	68,757	----	----	----	----	----	----	----	70,749	----

CALIFORNIA FRESH FISHERY PRODUCTS—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Sutter	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexico
Cuttle fish								1,570	547	1,337	30				3,484	
Limpets													8,350		8,350	
Mussels	210						564	765			2,096	300	8,425		12,460	
Oysters (shell)																
Eastern No.			482,355					987,975							1,470,330	
Oysters (native)			36,494												36,494	
Snails, sea																
Squid										67,911		79			68,020	
Miscellaneous—																
Frogs (doz.)								23							23	
Terrapin (doz.)						10		21			10				41	
Turtle, sea																82,000

A CORRECTION—In the October issue of CALIFORNIA FISH AND GAME, page 209, in the report on California fresh fishery products for April, May and June, 1919, there was an error in the catch shown for Los Angeles County. The tuna catch was 331,729 pounds and was shown as turbot. The blue-fin tuna catch was 1,659,119 pounds and was shown as yellow-fin tuna.

VIOLATIONS OF FISH AND GAME LAWS.

July 1 to September 30, 1919.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	54	$775 00
Refusing to show license on demand	1	10 00
Making false statement on application	1	20 00
Deer—excess limit—close season—killing or possession	31	840 00
Female deer—spike bucks—fawns—killing or possession	39	2,160 00
Illegal deer hides	15	300 00
Failure to retain head and horns of deer	8	425 00
Hunting on posted grounds	7	175 00
Fur-bearing mammals—close season—killing or possession	4	95 00
Nongame birds—killing or possession	3	30 00
Shore birds—close season—killing or possession	1	25 00
Cottontail and brush rabbits—close season—possession	23	520 00
Wild pigeons—close season—killing or possession	4	120 00
Doves—close season—killing or possession	11	225 00
Quail—close season—killing or possession	26	885 00
Ducks—close season—killing or possession	7	155 00
Tree squirrels—close season—killing or possession	1	----------
Grouse—close season—killing or possession	2	50 00
Total game violations	238	$6,810 00
Fish.		
Angling without license	13	$280 00
Fishing for profit without license	18	275 00
Trout—excess limit—close season—taking or possession	4	150 00
Trout—taking other than by hook and line	1	25 00
Striped bass—close season—sale—underweight—excess limit	16	495 00
Black bass—close season—sale—underweight—excess limit	2	50 00
Salmon—excess limit—Sunday fishing	2	200 00
Crabs—undersized—close season—taking or possession	2	40 00
Clams—undersized—close season—excess limit—taking or possession	6	150 00
Abalones—undersized—close season—taking or possession	3	75 00
Lobsters—under or oversized—close season—taking or possession	4	60 00
Dried shrimps—possession	8	180 00
Illegal nets	5	550 00
Pollution of waters	1	200 00
Total fish violations	85	$2,730 00
Grand total fish and game violations	323	$9,540 00

STATEMENT OF EXPENDITURES—YEAR 1919.

Items of expense	June	July	August
General administration	$2,242 94	$2,714 57	$3,037 71
Research, publicity and education	334 97	403 29	228 49
Printing	308 81		1,476 71
Fish exhibits			569 58
Game exhibits			
Tahoe Camping Ground		1,257 71	1,296 17
Mountain lion bounties	160 00	240 00	260 00
Lithographing hunting licenses		1,440 00	
Lithographing angling licenses			
Hunting license commissions	1.573 90	1,396 30	755 70
Angling license commissions	2,066 10	1,651 00	453 90
Market fishing commissions	7 00	38 50	54 50
	$6,693 72	$9,141 37	$8,132 76
San Francisco district	$6,680 73	$7,196 73	$7,480 37
Sacramento district	5,143 76	5,394 08	5,650 36
Los Angeles district	2,509 20	2,566 81	2,915 85
Launch patrol	1,435 64	1,069 94	2,393 80
Prosecutions (fish and game)	82 30		135 00
Crawfish inspection	200 00	122 58	100 00
Winter game feeding			
Accident and death claims	124 04	124 04	284 14
	$16,175 67	$16,474 18	$18,959 52
Hatchery administration	$1,215 11	$1,197 91	$983 65
Mount Shasta Hatchery	2,462 24	5,683 06	6,029 26
Klamath Station	5 00	5 00	617 07
Fall Creek Hatchery	390 95	826 96	442 03
Mount Whitney Hatchery	1,444 29	1,760 91	2,859 33
Cottonwood Creek Station		25 00	
Cottonwood Lakes Station	239 00	97 16	
Tahoe Hatchery	100 00	5 00	5 00
Tallac Hatchery	372 75	566 13	581 36
Chico Experimental Station	250 00	221 72	30 00
Fort Seward Hatchery	384 10	696 01	630 76
Eel River Station			
Ukiah Hatchery	311 01	496 02	139 15
Snow Mountain Station		157 00	
Brookdale Hatchery	388 05	492 30	442 98
Scott Creek Station	30 00	31 00	31 00
Feather River Hatchery			
Almanor Hatchery	332 70	162 50	149 36
Domingo Springs Hatchery	473 56	1,331 49	992 47
Clear Creek Hatchery	162 57	145 64	1,163 93
Bear Lake Hatchery	269 03	443 52	716 41
North Creek Station	208 25	31 34	
Wawona Hatchery	93 76	127 70	
Yosemite Hatchery	176 93	284 05	251 64
Kaweah Hatchery	112 51	156 21	180 54
Fish Transplanting	3 00	3 00	3 00
Screens, fishways and water pollution	635 84	686 19	883 30
Special field investigation			
	$10,060 65	$15,632 82	$17,132 24
Department of Commercial Fisheries	3,914 92	4,283 53	5,035 21
	$36,844 96	$45,531 90	$49,259 73

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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THE ABALONES OF NORTHERN CALIFORNIA.*

By WILL F. THOMPSON.

In northern California there are found three species of abalone: namely, *Haliotis rufescens*, Swainson, the red; *H. cracherodii*, Leach, the black; and *H. wallalensis*, Stearns, the northern green abalone. Earnest search has failed to reveal the abalone of British Columbia and Alaska, *H. gigantea*, Chemnitz. But one of these, the first named, is found in numbers rendering it of importance as food. It is exceedingly difficult to gauge the absolute abundance of this red abalone in any place without the aid of diver's apparatus. For that reason it has been judged best to give merely a record of the localities in which specimens were obtained, and a general statement as to the abundance along the various parts of coast. *H. cracherodii* reaches its greatest abundance to the southward of San Francisco, and it is present in northern California only occasionally.

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*California State Fisheries Laboratory, Contribution No. 17.

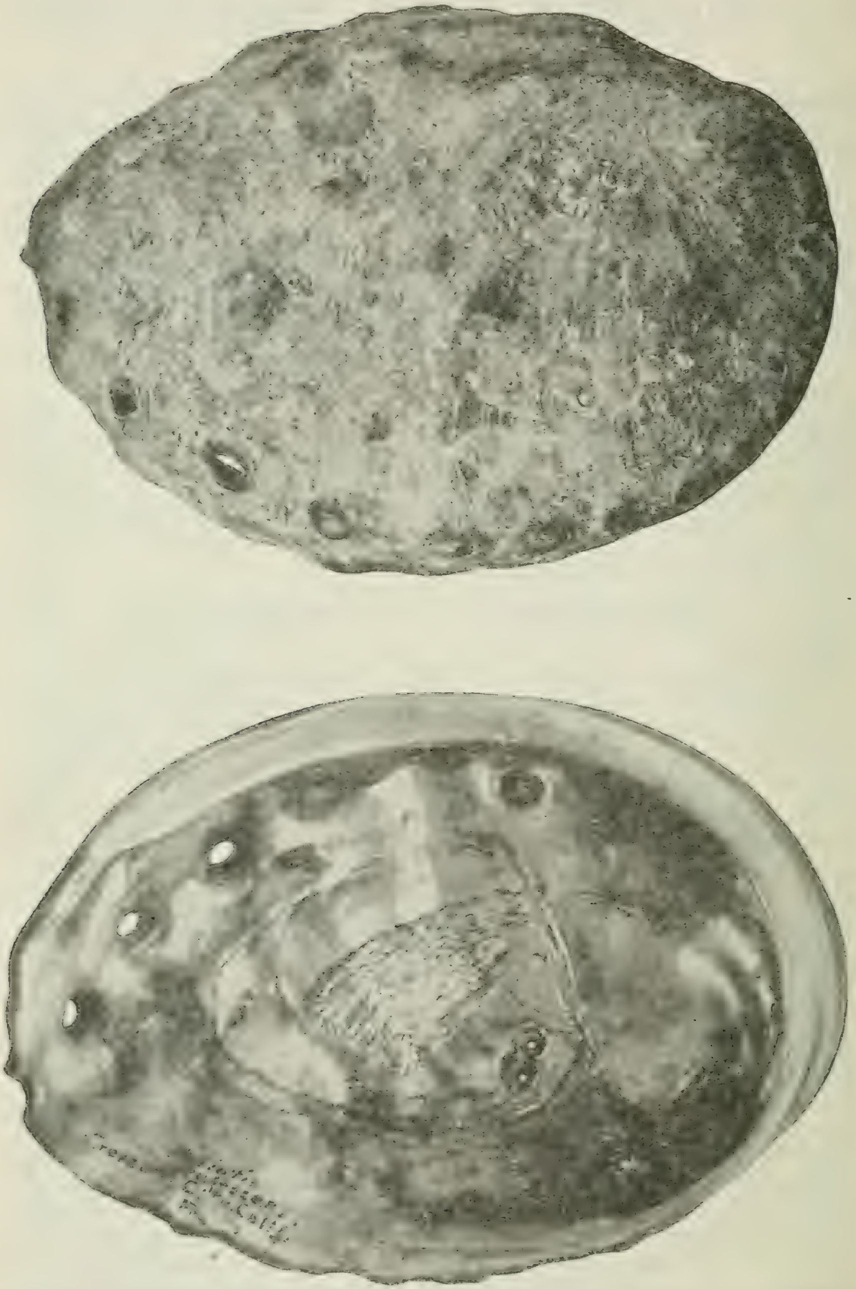

Fig. 16. Red abalone (*Haliotis rufescens* Swainson), from Crescent City, California Length 8½ inches.

Abalones dwell solely along the outer coasts, but there they dwell wherever they are afforded a foothold on or beneath rocks on a coast free from loose sand and mud. The red abalone is found below extreme low tide line and occasionally a little above, the black is at a higher level and rarely below low tide line, while the northern green abalone is found only at about low tide level as far as known. All species agree, however, in requiring a rocky, surf-beaten coast, and the localities given below are all of this nature.

Haliotis rufescens was found in some numbers in the following localities by others than the writer, if enclosed in parentheses:

(Point Saint George, rarely.)
Patrick's Point, rarely.
Cape Mendocino, rarely.
McNutt's Gulch, near Cape Mendocino.
Mattole River, 1 to 1½ miles north of Cape Mendocino.
(Punta Gorda.)
Spanish Flats, 124 degrees 15 minutes west, 40 degrees 20 minutes north.
(Fraser's Creek, near Cape Mendocino.)
Shelter Cove, abundant.
(Whale Gulch to Needle Rock.)
Bear Landing, in moderate abundance.
Usal, 123 degrees 50 minutes west, 40 degrees north.
(Rockport.)
Hardie's Creek.
(Union Landing.)
Abalone Point, 123 degrees 48 minutes west, 39 degrees 50 minutes north.
Bruhel's Point (McRay's Point).
(Kibesillah Rock.)
(Hare Creek and Beaver Point.)
(Caspar, 39 degrees 11 minutes north, 123 degrees 49 minutes west.)
(Newhaven Landing.)
(Manchester.)
Point Arena, abundant.
Arena Cove.
Buster Beach, 123 degrees 43 minutes west, 38 degrees 57 minutes north, abundant.
(Hayward's Beach.)
Saunders' Landing, 123 degrees 40 minutes west, 38 degrees 51 minutes north.
Bowen's Landing.
Gualala, 123 degrees 31 minutes west, 38 degrees 45 minutes north.
(Del Mar to Stewart's Point.)
Stewart's Point.
(Salt Point.)
(Fort Ross.)
Russian River.
(Bodega Head.)
(Tomales Point.)
Point Reyes, moderate abundance.
Duxbury Reef.
(Bolinas Point.)
(Double Point.)

From Point Saint George, the northernmost record, it was possible to obtain no live specimens, but Mr. Franz of Crescent City contributed a shell which he had kept for some time as an unusual specimen. At Patrick's Point live specimens were taken, and they were abundant enough so that eight or nine might be obtained by searching diligently throughout a low tide. Not until Cape Mendocino was reached were there sufficient numbers to render the species of importance, while at Shelter Cove, about forty miles southward, there was an abundance. From that locality to Point Reyes it might be considered that there was a slight increase in abundance when equally favorable situations were compared, and the effect of the relative amount of local use was considered. At Point Reyes, the abalone has been obtained by divers, with apparatus enabling them to go to considerable depths, and it is probable that such methods could be used as far north as Shelter Cove with success.

Haliotis cracherodii, the black abalone, reaches as far north as Point Arena, where an occasional specimen is found by local men. But one was obtained from that locality. They are also found at Duxbury Reef, and are reputed to be found now and then in the regions between Point Arena and San Francisco, but no actual evidence was obtained. In no locality in northern California do they reach any abundance,

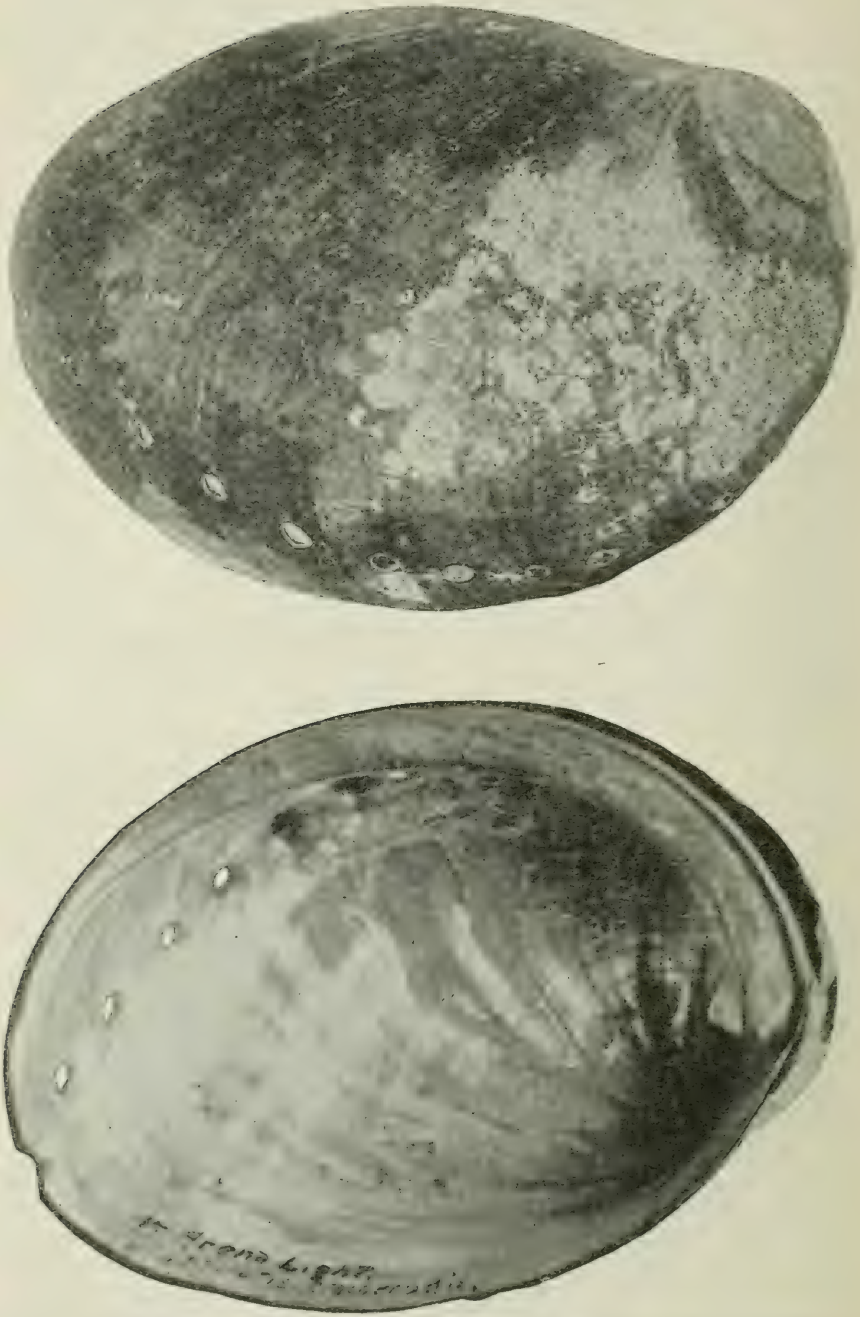

FIG. 17. Black abalone (*Haliotis cracherodii* Leach), from Point Arena, California. Length 6¼ inches.

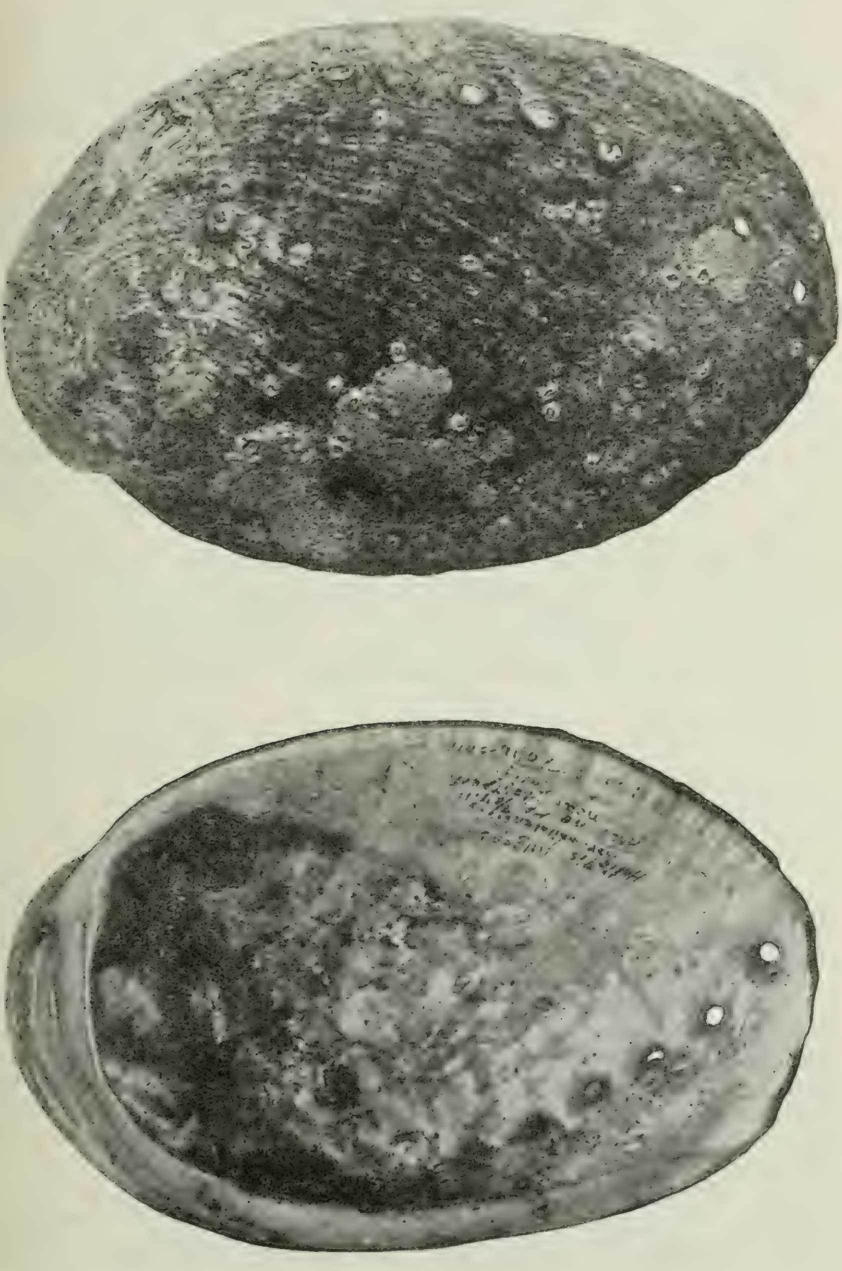

FIG. 18. Northern green abalone (*Haliotis wallalensis* Stearns), from Abalone Point near Westport, California. Length 4⅜ inches.

however, which would justify calling them anything but rarities until Duxbury Reef is reached, and it is safe to say that they will never be of commercial importance.

Haliotis wallalensis, Stearns, is a small species distributed along the coast between Westport and the Russian River, a distance of about a hundred miles. Although it is often found in numbers sufficient to be of importance to local users, it is small and little valued save for the very beautiful shells. Despite the extensive use made of abalones, the species has, to our knowledge, only occasionally been found south of the Russian River, namely at Monterey, where it is regarded as a curiosity.

It is here regarded as a species distinct from the green abalone of southern California, which it resembles in appearance. The type locality of the species is Gualala, where it was found by the writer in abundance, as also at Abalone Point near Westport. A single specimen was obtained at the Russian River, and one was obtained at Monterey from Mr. Ernest Dalder. Local inhabitants often fail to distinguish it from the young of the red abalone. It reaches, however, a length not greater than five and one-half inches, has five or six open holes (instead of the three or four of the red abalone), and the edges of these holes are not elevated.

In conclusion, it is evident that there is but the one species of importance found in northern California, namely, the red abalone, and all the commercially valuable beds of that are found south of Shelter Cove, over slightly more than half the length of the coast between San Francisco and the Oregon line.

SOME NOTES ON DRY-FLY FISHING. No. 3.

By R. L. M., California.

I do not believe that any one will disagree with the statement that it requires a little more skill to cast and deliver a dry fly properly than is needed to throw a wet fly. Such being the case, what are the principal factors that tend to promote or assist the skill thus demanded? There are several, among which the rod is one of the most important.

It is true that Mr. G. A. B. Dewar ("The Book of the Dry Fly," London, 1897) is rather inclined to underrate the efficacy of first-class equipment. He writes: "It is not the rod so much as the hand which wields it that kills the trout." There is no doubt about the correctness of this statement, and if we were all as skillful as the talented author of this book, no more would need be said on the subject of rods.

But unfortunately very few of us are able to devote more than a much too brief period to the delights of angling, and such being the case it behooves us to take every advantage that we can and to obtain everything that will enable us to meet the trout on a more even footing. Therefore we should equip ourselves with the best that modern ingenuity and skill can produce.

Casting or throwing the line out over the water is performed by the action of the rod which gets its initial impetus from the hand of the fisherman.

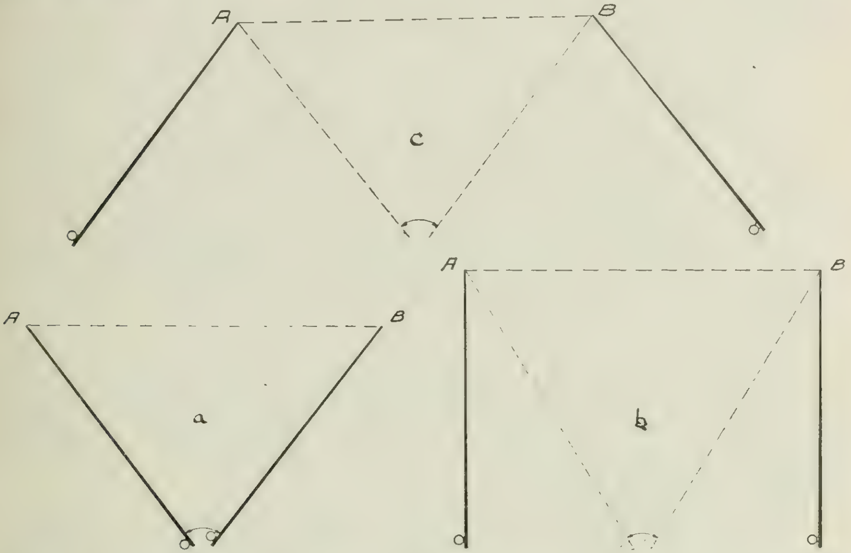

FIG. 19. Diagrams showing the mechanics of fly casting. Although the tip of the rod may be moving at the same speed in a, b, and c, yet in the first instance only would the line be properly cast.

In figure 19 "a" is a diagram meant to represent the rod at two instantaneous moments, viz. at the beginning and the end of the stroke that is made when casting. The tip of the rod, to which the line is connected, moves from A to B. Now if we could move the tip of the rod from A to B with the same speed as in "a," but at the same time while doing this, move the lower point of the rod an equal distance, we should not be able to cast (see "b," figure 19) nearly as long a line as in the first case. And if it were possible to make a motion with the rod similar to that illustrated in "c" of figure 19, we should find that to all intents and purposes we could not cast the line out at all. Yet in all these three cases the tip of the rod (to which the line is attached) would be moving through the air at the same speed. From the foregoing we can deduce that something more than plain motion of the tip of the rod is required in casting, and by regarding "a" again we shall decide that circular, or as it is called in mechanics, an angular motion of the rod is necessary to propel the line. But why does this angular motion produce results when the others fail? The answer is found in "a" of figure 20. The weight of the line and other causes prevent the tip of the rod from moving in synchronism with the lower parts and by the time the end of the stroke has been reached the rod is bent to the fullest extent that is possible for the particular weight or length of line being used for that individual case. The position of the rod at the end of the stroke is similar to that of a bent spring, ready to fly back to its unstrained or natural position (i. e., straight).

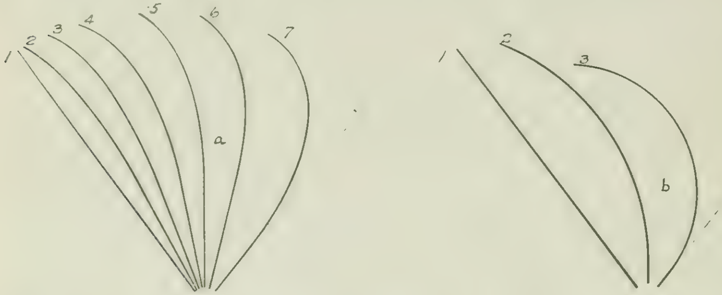

Fig. 20. Successive positions of the fly rod when in action, showing the "snap." It is the recovery of the tip similar to the action of a bent spring that furnishes the necessary impetus to the line. In b the action is too slow to be very effective, due to the bending qualities of the pole.

It is the recovery of this bent spring that furnishes the necessary impetus to the line. An absolutely stiff rod with no bend to it at all would cast a line, but not any length of line to speak of, and it would be a very tiring rod to use. On the other hand a rod with unlimited bending qualities would be too slow in action to be very effective (figure 20 ''b'').

While we have figure 20 fresh in our memories, and before going on to the other matters, I may remark that this illustration helps to demonstrate the correct manner of making a stroke with a fly rod. The casting stroke (whether backward or forward) should be started slowly, the speed should be continually increased to the end, where a more or less abrupt stop is made. This can only be done if the rod is held tightly or firmly by the hand.

When fishing with a wet fly all that we have to do is to lift the line off the water and cast it back again (figure 21 ''a.'' But when using a dry fly, nine times out of ten we have to dry the fly before returning it to the water. This means that instead of finishing off the forward

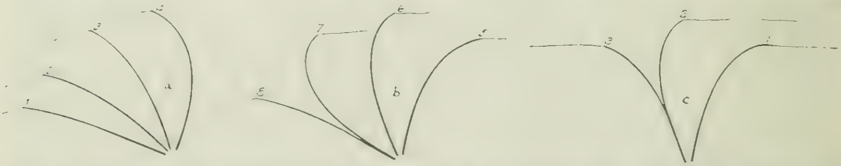

Fig. 21. Diagrams showing the mechanics of the false cast utilized in drying the fly in dry-fly angling. The line is checked before it reaches the water and is returned behind the angler, as in c.

stroke as at ''8,'' figure 21 ''a,'' we must be able to check the line before it reaches the water and return it behind us again. This is what is known as a ''false cast'' and it may be necessary to make four or five or even more false casts before the fly is dry enough to float once again. Figure 21 ''c'' illustrates the manner in which the forward stroke is checked when making a false cast.

It is in the making of these false casts that the virtues of a dry-fly rod become apparent. Quite a number of people think that the only difference between a dry-fly rod and a wet-fly rod is that the former costs more than the latter. Such, however, is not the case by any means. If we want a rod capable of extending a line of any length backwards and forwards in the air, we must have a rod that is able to impart the necessary impetus to the line with the least amount of angular motion possible.

In figure 22 I have shown the difference between the actions of a wet and a dry-fly rod; both are supposed to have an equal length and weight of line attached to them. Now it will be noticed that owing to the greater bending of the wet-fly rod, somewhat more vertical motion is imparted to the line than is the case with the dry-fly rod. In practice (i. e., when fishing) this extra vertical motion would mean that when using a wet-fly rod for dry-fly fishing there would be a probability that the fly, when being dried, would either strike the water in front, or catch up in the grass behind the angler; whereas, the same length of line could be easily extended in both directions without any danger of such mishaps if a good dry-fly rod was substituted for the wet-fly rod. A dry-fly rod is able to accomplish this because it has more resilience or more snap to its spring than a wet-fly rod has. We may therefore conclude that there is something more than a mere matter of price between a wet and a dry-fly rod. This difference is a structural difference and it consists of making the lower portion of a dry-fly rod much stiffer, i. e., less susceptible to bending than is the case with a wet-fly rod. Then again the middle section should be stronger or stiffer, because in the dry-fly rod the effective bending portion of the rod has to be concentrated within a shorter length than in a wet-fly rod. In both these lower sections the extra or added strength can only be obtained by putting more material, whether cane or wood, into the rod; but when we come to the uppermost portion or the tip, this must be delicate enough to enable us to use the very finest of leaders. It is a fact that a skillful dry-fly man uses finer leaders to land fish of two

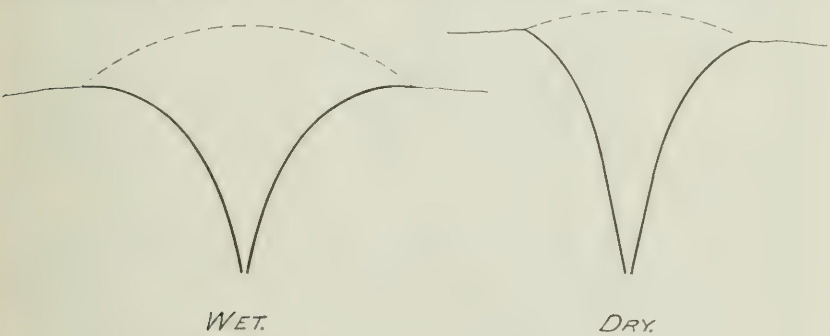

FIG. 22. Diagrams showing the difference in action between the wet and dry-fly rod. Owing to the greater bending of the wet-fly rod a more vertical motion is imparted to the line than is the case with the dry-fly rod.

pounds and over than the wet-fly man would care to use for the capture of trout of a quarter of a pound or less.

Now when we carefully consider the necessary qualifications demanded of a dry-fly rod together with the fact that the weight must be kept down to very small proportions, is it any wonder that all this refinement means a somewhat higher price for a dry-fly rod than is asked for the other type of rod? I do not want any one to run away with the idea that I am criticising wet-fly fishing. We are all familiar, at least I presume all my readers are familiar, with wet-fly fishing, and I am using wet-fly methods solely as a basis for comparison. For instance, I might say "John is a very tall man." But that does not give any very exact information; but if I said "John is six inches taller than Henry" it would not necessarily mean that Henry was short (he might be a six-footer); but it would give one a very clear idea as to just exactly how tall John really was, provided of course that he was familiar with Henry.

Each method, i. e., wet or dry, has its own particular field of action, and when fish can be caught with the wet fly it is a needless refinement to attack them with a dry fly; but when once a man has used the dry fly successfully, the tendency is, owing to its wonderful fascination, to continue the use of the dry fly whenever and wherever it is possible.

After having thus, successfully I hope, cleared my skirts of imputation of criticism or aloofness to the wet-fly school, I will continue the original theme.

The best length of rod for all-around dry-fly work will be found to be nine feet and six inches. If, however, most of one's fishing will be done on small streams where long casts are the exception, this length can be reduced by six inches. Do not expect to get a rod of the length first mentioned of featherweight lightness. Somewhere between five and six ounces will be as light a rod as it is possible to get and still maintain the necessary strength required. A nine-foot rod will be possibly one ounce lighter. Our grandsires used much longer and heavier rods. Francis Francis ("A Book on Angling," 1867) mentions four rods ranging in weight from 13 ounces, 4 drams to 14 ounces, 6 drams and in length from 11 feet, 7 inches to 12 feet, 8 inches. He, however, preferred a double-handed rod for his own use and he mentions two favorites, viz, 14 feet, 6 inches and 15 feet, 2 inches long. Lord Grey remarks on the wonderful accuracy with which Mr. Francis cast a small fly with such a large rod (p. 113, "Fly Fishing," London, 1899).

The reason why we are today using such shorter rods than formerly is chiefly owing to the introduction of the six-piece split cane rod.

David Foster ("The Scientific Angler," London, 1882) draws a comparison between the length of rods used in Walton's time and that of those which we use now. Charles Cotton, who wrote the second part of "The Complete Angler," and which was incorporated in the fifth edition (1676), gives five or six *yards* as being the best length for a fly rod which should be "made of fir wood for the two or three lengths nearest the hand and of other wood nearer the top." What that "other wood" was history does not relate.

Richard Brookes ("The Art of Angling," 1740) says practically nothing about rods, but Thomas Best, who wrote another "Art of Angling," 1787, specifies in his quaint way.

Ash	7 feet	
Hazel	7 feet	
Yew	2 feet	
Whalebone		6 inches
	16 feet	6 inches

In my copy, which is the fifth edition (1802), the same lengths and materials are given but not in this peculiar form, which reminds one of bookkeeping.

The action of these old-time rods was what we should call "very slow." By that I mean that when bent they were very slow in recovering to a straight position. Such being the case, it was necessary to have a long rod if the fly was to be cast any distance at all to speak of. Furthermore the rods could not begin to carry lines of the weight we use today. In Walton's time hair lines were used; during the early part of the nineteenth century a line of mixed hair and silk was the best that could be got, but when solid braided and dressed silk lines came in all the others were relegated to the scrap pile.

In connection with these ancient rods it is extremely interesting to read about the importance these old-time authors placed on the direction of the wind. It was a *sine qua non* with them to have it at their back. Some of them assert that it is impossible to cast against the wind, but even when they do admit that it can be done, they say it is a very difficult feat to accomplish successfully and warn the beginner against trying to do it. Everybody, however, did not use these double-handed rods. Colonel Hawker, in the fewest possible words, votes for a single-handed rod 12 feet 3 inches long; Pulman ("Vade Mecum," 1841) selects a "small rod about 11 feet long" and Francis Popham, who was a member of The Houghton Fishing Club from 1822 to 1858, was noted as having always fished with a single-handed rod.

Up to the time of the introduction of the close-grained tropical or subtropical woods there was no very great progress made in reducing the length of fly rods; but when these woods made their appearance, rod makers were not long in discovering their adaptability for light fly-casting rods. Greenhart, which is the best of all wood for this purpose (Wells "Fly Rods and Fly Tackle," N. Y., 1885), was first mentioned by Stewart in his "Practical Angler" (1857), but he classes it with logwood as being too "brittle and heavy," from which we must conclude that the greenhart he had in mind was not a particularly good specimen.

Mr. W. A. Hunter, manager for C. Farlow & Company, St. James Square, London, W., writes as follows in connection with this wood:

> Greenhart is not mentioned in the official records of the International Exhibition in 1851, and though our firm exhibited rods then, the kind of wood used is not mentioned, and we have no clear records left of that time.

It would seem from the above (taken in conjunction with Stewart's remarks) "that greenhart was first used in the manufacture of fishing rods somewhere about 1850-1857."

I have quoted Mr. Hunter, because of the fact that Farlow & Company have for years had a very great reputation for their greenhart rods.

A really good greenhart rod is a delightful weapon with which to cast ordinary fishing distances, and some of the men who have used them for a long time can not be induced or made to believe that there is something better than greenhart. The disadvantage of greenhart and all wooden rods is that in our dry climate they may in time become brittle, and when least expected and nearly always at an inopportune time, they have a habit of breaking off short at the junction of the wood and a ferrule. A well-made split cane rod will *never* break if treated as it should be. Whenever a man is seen at the waterside with a broken split cane rod, there are only two possible reasons for the fracture: one is that the rod was a worthless piece of goods to begin with, and the other is that the owner used it for something for which it was never intended.

With the modern six-strip cane rod, owing to its strength and resiliency, it is possible to cast a heavy line, to cast it to distances undreamt of by the earlier generations of anglers, and furthermore to cast across or right into the teeth of any wind short of a hurricane.

The only advantage that a long rod can have over a short one is that more command may be had over a hooked fish; but the rod is *not* the weak link in the chain; the weakest link is the extremity of the fine gut leader; *that* is really the factor that decides how much force we can use, and not the strength or length of the rod.

For comfort in fishing the handle or hand grasp should be made large enough so that no part of the hand is in contact with any metal. Furthermore the diameter of the handle should be such that the muscles of the hand do not become cramped by holding the rod. A rod handle that may seem comfortable enough for wet-fly fishing becomes a veritable torture if used for dry-fly casting owing to the fact that we have to cast so much more frequently. I refer to the false casts necessary to dry the fly. A properly shaped handle does not exactly add to the artistic lines of the lower extremity of the rod, but it *is* an infinitely pleasanter thing to fish with. It is a very great mistake to imagine that a rod can be made *effectively* lighter by paring down the handle. The balance of the rod is obtained by the weight of the reel and frequently, in fact nearly always, the reel and the line on it are not quite heavy enough to give a correct balance. If we take a rod into our hands and, without attaching the reel, we make a few strokes in the air with it, we at once notice that it feels top-heavy, or in other words there is a distinct sensation of weight felt. Now attach a reel or any other form of weight to the reel seat. The heavy feeling that the rod had has now vanished, or else it is not so noticeable. To arrive at a correct balance it is best to attach a moderate weight first and gradually increase it until the top-heavy sensation has completely disappeared. But note this: Sufficient weight must not be added so as to induce a too lively feel to the rod. If this is done the rod will be "over-balanced" and although the effort required in casting will be reduced to a minimum, the accuracy and control of the line will be to a great extent lost.

The fully equipped rod should balance at a point about three to five inches above the upper end of the handle (or hand grasp). There is no rule or formula by which this point can be found. The only satisfactory way is by the trial of various weights as already explained. When the correct weight has been found, deduct the weight of the reel and line from this, and make up the remainder by an equal weight of soft lead wire, which can be wound on to the empty spool of the reel before the line is wound on. The best type of reel to use is a contracted single action click (adjustable) one. With such a reel the line can be wound in as fast as with a multiplier; the spool is short or narrow but the diameter is large. The best that have been procurable up to the present have been the best grade of English made reels (See "Saturday Evening Post," August 9, 1919; "Very Efficient" Camp in "Fishing with Floating Flies," 1916; Geo. P. Holden "Stream Craft," 1919, says they "are exquisite"), but one of the leading American reel companies will shortly place a first class fly reel on the market.

Charles Zibeon Southand, in "Trout Fly-Fishing in America," 1914, gives a table of lengths and weights of rods and the proper weight of reel to balance them. He bases his table on the supposition that the reel should weigh half again as much as the rod. Using this table as a starting point a four-ounce rod would call for a six-ounce reel. A 3½-inch reel will weigh about five ounces, which gives us one ounce of margin for the line. If this is not enough a slightly smaller reel weighing less could be used. However, it will frequently be found that the very light rods need a lot of counterweight to properly balance them.

A 9½-foot, 6-ounce rod that I use a great deal for dry-fly fishing is perfectly balanced by a total of 9 ounces made up of reel, line and lead wire.

A tapered oil-dressed silk line is the only one to consider in connection with this kind of fly-fishing. These lines are prepared by soaking them in pure boiled, or cold pressed, linseed oil. Mr. Martin E. Mosely, one authority, advocates the former; and a description of his method will be found in Halford's "Dry-Fly Man's Handbook." A copy of this (i. e., the line dressing) appeared in "The American Angler," December, 1918, under the heading "Dress Your Own Line." Another great authority on this subject, viz, Mr. W. D. Goggeshall (an American and past president of The Fly-Fishers Club, London), writes in a recent issue of "The Fishing Gazette":

> Never use air pump; always put line in *hot* oil; heat oil so hot that it will burn your finger, put line in oil, keeping heat up until air bubbles seem to rise; take off the fire and allow line to cool in oil and hang line up to dry. Better to *stretch* line first, though. To get a *perfect* surface apply cold oil when line is stretched and dried. Be sure that *every* coat is *thoroughly* dry before second coats are applied. Rub down smooth and polish with soft rag and talc powder.

Mr. Perry D. Frazier, of Ridgewood, N. J., who is the author of one or two books on angling matters, manufactures oil dressed lines that compare very favorably with the best imported article.

Different methods are used for gauging these tapered lines. Some manufacturers call them "No. 1, 2, 3," etc.; others use the alphabet and specify "D, E, F," etc.; consequently unless we know the *weight* of the line it is not much use saying that such and such a rod should have an "F" or "E" line, as the case may be. The line should fit the rod. By this I mean that the line should be sufficiently heavy to fully develop the casting power of the rod. If the line is not of sufficient weight when the casting stroke is made the rod will not be bent far enough to fully develop its spring (see figure 20) and it will take considerably more effort to cast the line than would be necessary if the proper size or weight of line was used. On the other hand, a line that is too heavy for the rod will in a very short time completely ruin it.

For ordinary occasions, i. e., when the wind is not too strong, a 9-foot tapered leader is advisable. It should be tapered from fairly heavy gut at the upper end down to the "finest undrawn" at the lower extremity. Finest undrawn gut is approximately the same sixe as X drawn gut; but the undrawn gut is about 15 per cent stronger than drawn gut of equal diameter. These undrawn gut leaders are very scarce and extremely hard to get hold of; consequently most of us will have to be content with leaders whose fine points are made of drawn gut. Drawn gut is listed as X, XX, XXX, etc., but anything less than XXX is rather too fine for the sort of fish we hope to catch. I might mention, however, that trout of over five pounds have been caught on XXX leaders.

When a strong wind is blowing the length of the leader should be reduced to 7½ or even 6 feet, but do not make this reduction by cutting off from one or other end of the leader. Get these short leaders made up just the same as the longer ones, i. e., fully tapered from end to end. I do not believe there is any economy in buying gut in hanks and making up one's own leaders. To make up a good tapered leader several hanks of gut would be required.

There are 100 strands in each hank and if they were all made up into leaders we should probably have about 70 or 80 leaders on hand. Gut does not improve with age; consequently long before we got to the end of our leaders we should find that they were beginning to deteriorate and in all probability the last few dozen would have to be thrown away, thus wiping out at once any paper profit that might have been theoretically possible. Some people will tell you that they always make up their own leaders and that bought leaders are no good. There is but one answer to this and it is: Where did they buy these poor leaders? If leaders are obtained from reputable houses and a good price is paid for them they will be all that any one can desire and much better than 99 per cent of us could make for ourselves. I always aim to use up my leaders every season and not to carry any over to the next; then I know that the leaders I am using are the best that can be got and are not weakened in the least by age. There are several substitutes for gut. They generally have queer sounding names and are not as strong as gut of equal diameter. They are more opaque than gut, and when they get wet they become so soft and limp that they do not lay the fly out over the water properly; therefore, they are not to be thought of in connection with dry-fly fishing.

There are several other appliances peculiar to dry-fly fishing and I will mention them briefly. The first is the "line greaser" which is a little folded leather pad which has several sheets or folds of cloth inside. These are liberally doped with some grease, such as red deer fat, mucilin, vaseline, or mutton fat. Before commencing to fish the line (not the leader) is rubbed down with the greaser in order that when it is cast it will float on top of the water. Then there is the oiling device. This may be a small atomizer, or a little bottle with a small brush, or a small metal box with some felt pads well soaked with the oil used to assist the fly in floating. Oil is not necessary to make the fly float. Before it was used flies were made to float and some men still refuse to use it; but all said and done, oil is a wonderful help. When it is used a fly will never become quite as wet as it will if it has not been annointed, and furthermore a wet fly that has been oiled can be dried much quicker than an unoiled fly. The dry-flies are kept in a box and not in a book, because they should not be crushed. There are numerous kinds of fly boxes on the market and I hope to give illustrations of several of them in one of the future series of these notes.

A landing net is one thing that can not be dispensed with. It should be large and have a handle of fair length. There are a number of folding nets on the market. Some are too small for anything but very little fish. A span of sixteen inches across the mouth of the net is not too much, and the net itself should be at least twenty inches deep. It is much better to have a landing net of the large size than to have one that is too small. Imagine the feelings of a fisherman with a five-pound trout ready to land, and a net so small that it would be difficult to lift out the fish with it even if the fish were dead. The best thing to do in this case is to throw the net away and pull out a handkerchief and, taking this in your hand, lift out the fish; but be quite sure the fish is all in before you try to do so.

And finally there is the creel or basket in which to put the fish we expect to catch. Get a good-sized one, one that will take a two-pound trout without bending the fish. Above all things get one that is not easily opened, for two reasons: if it opens easily it may act without your knowledge and dump some of your fish on the scenery; and if it is easily opened some inquisite stranger may casually open it when there are no fish inside for the I. S. to admire and for the owner to feel proud of.

Having briefly described the implements used in the art, I propose to give a demonstration of their use in the next issue of CALIFORNIA FISH AND GAME, which will be before the public just about the beginning of the vacation season.

THE MULLET FISHERIES OF SALTON SEA.

By Will F. Thompson and Harold C. Bryant.

The Salton Sea is, in reality, a portion of the Gulf of California, cut off by the enlargement of the delta of the Colorado River. It has been, consequently, evaporated to relatively high salinity during each of the long periods when the Colorado River emptied its waters into the gulf. Geologists believe, in fact, that the river has periodically emptied its flood in to the Salton Sea, raising its level, and extending its area, just as it did during 1906. At present the Colorado is prevented from doing this by the dikes along its banks, built in order that the Imperial Valley may be safe, and that it may be irrigated, but the irrigating canals carry a certain amount of waste water into the sea. There are, in addition, fresh water springs, notably one called Fish Spring, which pour considerable amounts of fresh water into the sea.

Little is known about the fisheries of the Salton Sea before the last break in the jetties of the Colorado River. In 1905 the water of the Colorado River poured down what are now known as the New and Alamo rivers in a great flood which carried 160,000,000 cubic feet of water into the sea daily. The result was a great enlargement of the sea and the extensive freshening of its waters. The extension of the sea buried the Southern Pacific lines along its shores, covered the adjacent territory which at that time was beginning to be placed under cultivation, and threatened great financial loss to the Southern Pacific Company, which owned alternate sections of land throughout the territory. In 1906 the break was closed by the Southern Pacific Company, after a spectacular struggle. It was through this break that the fishes now, or recently, present, entered the Salton Sea.

During the earlier portion of the period since 1906, considerable numbers of "carp," if the indentification of others than scientists be trusted, were to be found in the sea, and some eight years ago a promoter started a company with the idea of using these carp, and other fresh water fish, for oil and fertilizer. Having built the proper buildings, installed machinery and launched boats in the sea, the company was unable to operate because it was unable to find sufficient fish. At this time, Captain Chas. Davis, who came originally from New England and was familiar with fisheries of all sorts from an extensive experience on all our coasts, went to Salton Sea to investigate the likelihood of extensive fisheries being built up. His report was adverse. The company for some time endeavored vainly to dispose of the equipment, but was unable to until they accepted Davis' offer of $500. The latter then scrapped all the machinery, turned the buildings into a pleasure resort for the people of the valley, and took up land in the vicinity when the sea had subsided sufficiently. The buildings are now more than a mile from the sea.

However, five years ago, in 1915, mullet (*Mugil cephalus*) began to appear in the sea, and Davis placed weirs of wire netting along the shallow shores of the sea to impound them. He was able to obtain a large amount of fish at times, but could not develop a market for them at the time, even in Los Angeles and San Francisco. Attempts to sell the fish in the Imperial Valley were fruitless, the fish being named "cow-carp" and regarded as very poor. These attempts, however, laid the foundation for a later very good demand. The approach to Captain Davis' land being cut off by the overflow from irrigation ditches, he was prevented from pursuing the fishery until the last year, but certain Japanese and Greeks did catch considerable quantities, using much of the mullet for oil, and shipping some to market. The Greeks still operate. In the last year Captain Davis has again begun shipping mullet, catching them by means of halibut trammel nets. The catches during the winter months by two men using eight trammel nets of thirty fathoms length each, comprise but 250 or 300 pounds daily, taken in the vicinity of the mouths of the rivers, in shallow water. These fish are landed and shipped from Niland to Los Angeles or San Francisco. Captain Davis receives 15 cents per pound for the fish at the station.

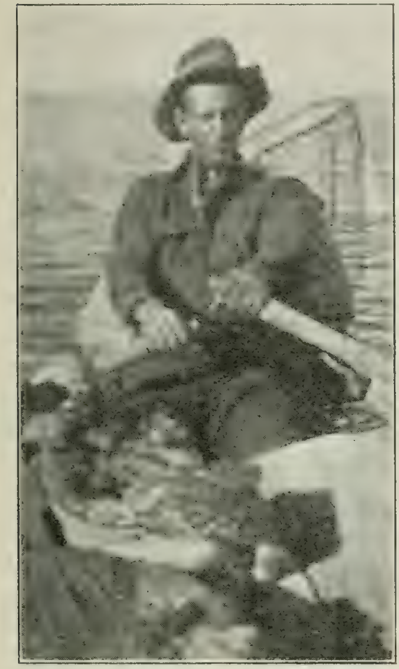
FIG. 23. Captain Charles Davis, a mullet fisherman of the Salton Sea, Imperial County, California. Photograph by H. C. Bryant.

The recession of the sea has made considerable trouble so far as landing the catch is concerned. As the fall is only about four feet per mile, there are great flats covered with water only six or eight inches deep, in which a boat can not easily be moved. Captain Davis has in

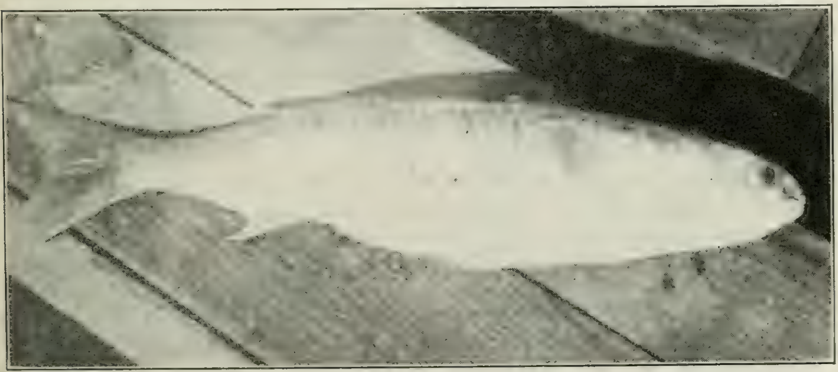
FIG. 24. The mullet (*Mugil cephalus*), a desirable food fish now found in numbers in Salton Sea, Imperial County, California. Photographed by H. C. Bryant.

a measure overcome the difficulty by making a shallow canal, up which his boat can be pulled part way by means of a picket line and the remainder of the way can be pulled with a tow line.

According to Captain Davis mullet are found in different locations in the sea at different seasons. During part of the year they are found in great numbers on the west shore of the sea in grass which grows profusely there and upon which they feed, being vegetarians. On a visit to Bird Islands, on the west shore of the sea, on December 18, 1919, there was no evidence of mullet, and yet at times large numbers are said to be caught in this vicinity.

The fish are at present of very large size indeed, being between two and two and one-half feet in length. The flesh is oily in the extreme, yielding fully a quart of clear oil to the ten pounds of fish. This oil, of a delicate flavor, renders the canned mullet a delicacy, and samples put up by a Los Angeles firm were found to be very palatable. The fact that the fish is delicious should have been expected because of the very high esteem in which it has been held from ancient times, domesticated mullet being known in Europe since the times of the Romans. The species is found all along our coasts, from Monterey southward, and occasional schools are taken in every sheltered lagoon or bay, as well as occasionally up the rivers in what is really entirely fresh water. Its occurrence in the Colorado River is not highly remarkable, and its transference to the Salton Sea would have been expected by anyone familiar with its habits.

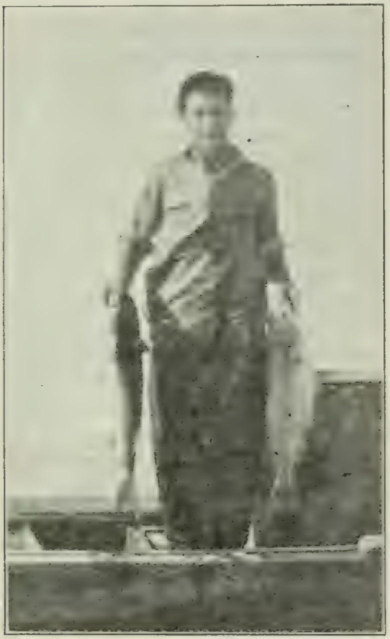

FIG. 25. Mullet fisherman with part of his catch. Photograph by H. C. Bryant, December 19, 1919.

There is also present in the Salton Sea a species of top-minnow *Cyprinodon macularius,* which is found in the streams and springs of the desert throughout Southern California and parts of Mexico. They are said to be abundant in the sea at times, and specimens were obtained for us from there and from Fish Spring by Captain Davis.

It is, indeed, very questionable whether the mullet will exist for any length of time. The carp, and other fresh-water fish in the sea, died some years ago, according to Captain Davis' recollection, after a heavy blow which mixed the waters, drifting them ashore in great quantities. During the past two years there have been statements made to the effect that the mullet also have been found on certain shores of the lake in great quantity, apparently dead from poisonous waters. It is certain, moreover, that the sea has been steadily falling, at the rate of 4½ feet yearly, and as the sea is everywhere shallow (perhaps 25 or 30 feet deep) it is plain that it can not last long at such a rate of fall. Analysis of the water at a distance from river mouths shows it to be three or four times the salinity of ocean water. The water, moreover, is not merely saline. If such were the case, it is probable that the mullet, a salt water fish, would survive indefinitely. But as a matter of fact the water is fed from alkaline springs, and has in the past been alkaline in nature, so that the water must become poisonous rather than merely salty. Regarding this, however, there is some question until chemists are able to analyze fair samples taken annually, but the probability is very great that the mullet will be unable to exist.

The area near the center of the mullet fisheries should prove of great interest to the geologist. Mullet Island is a typical volcanic plug. At the edge of the island a number of hot springs boil out, leaving chemical deposits of several colors, similar to those of Yellowstone National Park. Captain Davis, by impounding the waters of these springs, has succeeded in obtaining two different colored "paints," and in a third reservoir a pure deposit of rock salt Near the island are some mud volcanoes the cones of which are from five to eight feet in height. A spring in this vicinity also is geyserlike in action, boiling out with considerable velocity periodically. Because of these natural phenomena the island is visited by large numbers of people from the Imperial Valley every week.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

APRIL 19, 1920.

"There must be a balance between the agencies of destruction and those of conservation. When there is nothing left to conserve then we must give up all of our ideas of sport."—Emerson Hough.

ADDITIONAL GAME SANCTUARIES.

Through an oversight the list of California's game sanctuaries as given in the January number of CALIFORNIA FISH AND GAME lacks the following:

Name	County	Area	Established
4F	Los Angeles and Kern	23,040	1919
1M	Kern	80,640	1919
3E	Santa Clara	3,840	1919

This adds a total of 107,520 acres which should have been included in the statement, making a total in all of 3,107,520 acres. Sanctuary 4F was set aside especially to protect the few antelope which may still exist in the eastern end of what is known as "Antelope Valley," in northern Los Angeles County.

THE GAME WARDEN AT WORK.

The scene is laid in one of the small national parks in the Southern Sierras. A state game warden, on the look out for violators, is camped within the park for the night. A shot is heard at dusk. The warden gets up early the next morning and goes to the spot from which the shot was heard and there discovers blood upon the ground. A little search also discloses the entrails, head and skin of a doe. The warden hides the head and hide and makes his way to the camp of some woodsmen just outside of the park. A man found at the camp is asked if he has any deer meat. He replies "No." The warden notes on the back of the woodsman's hunting coat a large patch of blood, apparently made by carrying a deer into camp. When questioned the woodsman states that he does not know what caused the spot of blood. The warden asks permission to enter the cabin and make a search and is given this permission. On entering the cabin the warden discovers a flour sack filled with fresh venison. The woodsman then admits that his brother has killed a deer. He is then asked if the deer was killed within the national park and is told that it was not. The game warden then leads the woodsman to the spot where he had hidden the head and hide of the doe and the woodsman is made to admit the fact that the doe had been killed within the national park. The outcome, of course, is a heavy fine to the violator.

In California game wardens can tell you many such stories as the above. The violator is nearly always a man ready to perjure himself and do anything to avoid a court sentence. Talk to a game warden and you will soon discover that it is not the detective alone who must be clever in sleuthing and in the gathering of reliable evidence, for the game warden must not only act as police and prosecutor, but he must also be a clever detective, if he is to bring violators to justice.

DRY YEARS INJURE ANGLING PROSPECTS.

Dry years are coming to be viewed with grave apprehension by the angler, for he knows that his sport is always curtailed by a lack of water in the streams and lakes. Planting activities have been coming to naught as a result of the lack of water. In many streams and lakes where large numbers of fish have been planted, and where a noticeable increase has taken place, there has been a depletion in the abundance of fish due to drought. Two power reservoirs in the Southern Sierras, Huntington Lake and Shaver Lake, although heavily stocked in the past few years, will furnish but poor angling the coming season because of the fact that thousands of fish have died owing to the present low water and consequent poor food supply. Many streams when they again run bank full will contain but a small proportion of their former stock of fish. Every angler should look with favor on future storage reservoir projects, for in an increase of such reservoirs lies a partial solution of the problem which presents itself with each dry year and its consequent low water.

GOVERNMENT AND FISH AND GAME COMMISSION INAUGURATE FREE NATURE GUIDE SERVICE.

So successful was the summer resort work inaugurated by the California Fish and Game Commission at the Tahoe resorts last summer, that it drew the attention of the federal government, with the result that a similar nature guide service will be installed in the Yosemite Valley the coming summer. The Superintendent of National Parks has secured the cooperation of the Fish and Game Commission to the extent of the commission's furnishing Dr. H. C. Bryant, who instituted the work at the Tahoe resorts, for the work in Yosemite. Dr. Bryant will be assisted by Dr. Loye Holmes Miller, of the Southern Branch of the University of California.

Evening lectures dealing with wild life will be given at the various camps and trips afield will be conducted, including special trips for children. Office hours are to be arranged so that questions regarding natural history can be answered. This summer resort work offers a splendid opportunity for the Fish and Game Commission to employ the educational method in making conservationists out of summer vacationists. In no other way could the commission come in touch with so large a number of people in so short a period of time.

IN MEMORIAM.

CHESTER A. SCROGGS.

We regret to announce the death of Deputy Chester A. Scroggs, whose death occurred January 29, 1920, after a short illness at his home in Loomis, Placer County.

Deputy Scroggs was appointed special deputy June 19, 1908, and regular deputy September 1, 1911. He was attached to the Sacramento Division, and for three years up to the time of his death was in charge of the launch patrol of the district. By his activity and thoroughness he developed this arm of the service up to its present stage of efficiency.

Chester Scroggs was utterly fearless and resolute in the discharge of his duty. He believed the fish and game laws were placed on the statute books to be enforced. There was no obstacle or hindrance too great to deter him from his duty as he understood it. Nothing could deviate him from his purpose. If he had a fault it was over-zealousness—if that can be termed a fault. He had no censure for any but the slacker of duty. Still he was fair and conscientious in his dealings with violators with whom he came in contact. They both feared and respected him.

At the time of his death he was forty years of age. He is survived by a widow and two small children, a boy and a girl, also a sister. He was a member of the Masonic fraternity and the Order of Elks.

He is mourned by his many friends in private life and his brother workers on the Fish and Game Commission.

FOREST NESBITT.

Deputy Fish and Game Commissioner Forest Nesbitt died of pneumonia at his home in Salinas, Friday, March 5, 1920, after only a few days illness following a severe cold contracted while on patrol duty.

Mr. Nesbitt was appointed Deputy Fish and Game Commissioner, December 1, 1917, after qualifying by civil service examination. During his time of service, he proved his fitness for the trust that was placed in him. His training under his father, who has been sheriff of Monterey County for many years, gave him previous experience that was of the greatest value. In every prosecution his fairness was apparent. No one was taken into court unless their guilt was certain. Believing in the strict enforcement of the laws protecting wild life, his influence brought about a better compliance with the law in every section to which his work took him.

To the father, mother and wife and others that were near and dear to him, the Commissioners and fellow-employees extend their heartfelt sympathy.

FOREST OFFICERS' REPORTS.

For several years past the Forest Service has, through the medium of annual reports from each supervisor, furnished valuable information as to the distribution and past and present status of fish and game. During the coming year forest officers are to furnish information according to the following outline recently submitted to them. As can be seen the outline emphasizes knowledge as to distribution and life history of the more notable species.

LIFE HISTORY.

A. Big Game.

Moose, elk, antelope, mountain sheep, white-tailed deer, black-tailed deer, black and brown bear, silver tip or grizzly bear.

Mating and breeding habits, number and care of young, food and range at various seasons of the year, condition and abundance, diseases and effect of climatic conditions, rutting season, when young are born, when are horns shed, any other information bearing upon the desirability of the species or its adaptability for extension work.

B. Game Birds.

Ducks and geese and other waterfowl, if any; grouse, give exact species found; quail, partridge, pheasants, ptarmigan, etc. Anything relative to their breeding and nesting season and habits. When eggs are laid and number of young, abundance or scarcity.

C. Small Game.

Rabbits, tree squirrels. Their relation to forestry and value as game animals, abundance, or scarcity, need for protection, if any.

D. Fur Bearing Animals.

Species found in locality, breeding habits, season when fur is prime and value. Any available information as to the extent of the local trapping industry. Special attention to beavers.

E. Insectivorous and Song Birds.

List various species found together with all interesting information at hand concerning life history and habits.

F. Predatory Animals.

Wolves, coyotes, mountain lions, foxes (various species found), wild cats, lynxes, etc. Specific cases of loss by predatory animals.

Damage done by these species to game. Abundance or scarcity. Range and food at various seasons. Any useful information in exterminating them not hitherto reported.

(Note—Several of the species listed may also be discussed under Fur Bearing Animals.)

G. Predatory Birds.

Eagles, hawks, etc., various species found. Amount of damage they do to game animals and birds. Life history and habits.

H. Fish.

Trout—rainbow, eastern brook, native and others. Bass—small and large mouth. Other game fish—abundance or scarcity of species, spawning season, migration, character of water best adapted to each, use of fish ladders and screens. Information as to any successful device for screening headgates or ditches is especially desired.

Streams needing stocking; number of fish needed for each, with specific shipping instructions. Cost to Forest Service, amount of cooperation, etc.

DISTRIBUTION.

In submitting the above report, information which will extend the known ranges of the following mammals and birds is very much desired. Below you will find a list giving you a brief summary of the range of each species. If you locate definite records of the occurrence of any of these birds or mammals outside of the limits given, do not fail to submit evidence. The best evidence is a specimen. Ship specimens direct to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, California, by express, carefully marked "specimens for scientific purposes." We are especially anxious to get specimens of deer taken in San Luis Obispo and Santa Barbara counties and throughout the Sierras to outline more accurately the range of various species. Specimens should be taken during the open seasons. Permits will be issued on application for protected species.

White-tailed Deer.

Range—Said to have formerly occurred in extreme Eastern and Northeastern California, chiefly in the Modoc region. Many accounts by hunters, but no verified or recent report.

Columbian Black-tailed Deer.

Range—Northwest coast region, chiefly in the Transition (yellow pine belt) and Boreal (Lodgepole pine belt upward) zones; east throughout the inner coast ranges to the Sacramento Valley, and at the north to and including Mount Shasta and near vicinity; south to the north side of San Francisco Bay.

Southern Black-tailed Deer.

Range—Transition and high Upper Sonoran (chapparal belt) zones south from San Francisco Bay through the Santa Cruz district, at least into Monterey and San Benito counties.

Rocky Mountain Mule Deer.

Range—Eastern California, including main Sierra Nevada south into Kern County and north to vicinity of Mount Lassen, thence northeast through the Modoc region. Western limit at extreme north, Mount Shasta (Rowley, M. S.). Not in the desert ranges east of Owens Valley except in winter. Occurs in summer on the high Sierras up to timberline; in winter most numerous in the foothills.

California Mule Deer.

Range—Upper Sonoran and Transition zones of Southern California west of the desert proper, from the Mexican line northwest through the San Diegan district at least to San Luis Obispo County, and east through the Tejon region to the Tehachapi Mountains.

Desert Mule Deer.

Range—Imperial Valley.

Northwestern Timber Wolf.

Range—Northern California, and south along the Sierra Nevada. Now rare or extinct. The number of records (e. g., Price, Zoe, 4, 1894, p. 331) and reports from the region specified carries conviction that a wolf of some form has occurred as above indicated. But lack of specimens brings doubt as to the race represented.

Sierra Nevada Wolverine.

Range—Boreal zone on the Sierra Nevada, from the vicinity of Mount Shasta, south through Lake Tahoe region to Monache Meadows, Tulare County.

Yellow-haired Porcupine.

Range—High Transition (yellow pine belt) and Boreal (Lodgepole pine belt upward) zones along the Sierra Nevada, from Mount Shasta to the vicinity of Mount Whitney.

Sierra Grouse.

Range—Common resident of coniferous timber in the upper Transition and Canadian zones of northern California from Mount Shasta south along the inner coast ranges at least to Mount Sanhedrin, and along the Sierra Nevada south through the Mount Whitney region to the Piute Mountains, Kern County. Also on the Warner Mountains of Modoc County, on the White Mountains, Mono County, and on Mount Pinos, Ventura County.

RECORD ANY RECENT OCCURRENCE OF:

Grizzly Bear.

Columbian Sharp-tailed Grouse.

Former range—Occurred formerly as a fairly common resident on the Transition plains of the Modoc region; Canoe Creek, 50 miles northeast of Fort Reading, and upper Pit River; Camp Bidwell. No information is at hand confirming its existence within the state at the present time.

Sandhill Crane.

(Especially record of nesting.)

Range—Fairly common summer visitant to the northward interiorly; at least a few winter in the San Joaquin Valley. Recorded as breeding in the northeastern corner of the state; summer records also from Alpine Meadows of the Northern Sierras (several records), and from the San Joaquin Valley south to the Tulare Lake region.

Breeding of ducks, geese and jacksnipe in the Sierra region.

A BILL TO ESTABLISH GAME SANCTUARIES IN NATIONAL FORESTS.

With the view that certain areas within the national forests may be set apart as game sanctuaries, a bill was introduced in the United States Senate on June 21, 1919, by Senator Nelson, looking toward the dedication of more of the national lands to conservation purposes. The national parks and monuments have for some time been set apart as game refuges, and the bill in question would also set apart sections of the national forests to the preservation of our wild life. This bill covers practically the same points as a bill previously introduced by Senator Chamberlain, but which never came to a vote by the Senate. The Nelson bill covers the following propositions:

Section 1. A federal law empowering the secretary of agriculture to select areas in national forests suitable for game sanctuaries; these sanctuaries to be established by presidential proclamation but with the approval of the governor of each state; and to be so located that they shall not prevent the allowing of grazing or other uses thereof as are in conformity with the laws applicable to national forests.

Sec. 2. Prohibiting the hunting or other destruction of game within such sanctuaries, except as otherwise in the act provided, and providing penalties for the violation of such provision.

Sec. 3. Administration of the provisions of the act to be vested in the secretary of agriculture, with power to regulate the killing of predatory animals.

Sec. 4. Providing for the establishment by the secretary of agriculture of boundaries and for postings showing the location thereof and warning the public of the prohibition of hunting therein.

Sec. 5. Setting forth the purposes of the act: That it is expedient to establish a large number of sanctuaries of medium size rather than a few large preserves, the ideal condition to be a chain of sanctuaries, with the view of providing breeding places for game which will spread over adjacent and intervening territory, where it will be subject to the regular open season provided by law.

There is crying need for such a law as this, for millions of acres of some of our national forests are utterly destitute of game, and great opportunities to create a vast annual supply of big game are being wasted by lack of intelligent and resolute action. It is to be sincerely hoped that this measure will not, like the Chamberlain bill, be allowed to slumber in the archives of Congress, but that some definite step will be taken.

SAN DIEGO TO MAKE CLEAN SWEEP OF THE ENGLISH SPARROW.

The city of San Diego resolved that she would rid herself of the English sparrow. So in 1916 a city ordinance was passed providing for ways and means for the extermination of this pest and appropriating the sum of $125 for such purpose. The task of destroying sparrows inside the city limits was delegated to one man, and ever since the ordinance became effective he has been on the job. From the first the campaign has been successful and the sparrow pest is now not only under control, but this spring San Diego expects to free herself entirely of the sparrow. The city this year is allowing ten cents each for every sparrow killed, up to $50, and in addition the Chamber of Commerce is also offering ten cents each up to $30. The record for this year shows 250 dead birds, and it is estimated that there still remains about 100 sparrows in the city. It is expected that as soon as the mating season is well under way and the sparrows begin nesting that a clean sweep can be made of all these remaining birds.

Other cities in the state might well follow the example set by San Diego. Even in cities where sparrows are far more numerous the appropriation of a small sum of money and the appointment of an energetic and ingenious man to carry on the work of destruction will lead to a near solution of the sparrow problem. A city that can advertise itself with the slogan "No house sparrows here" adds to its reputation—Webb Toms.

FISH PACK, 1919.

In this issue is given a complete report of the canned, cured and manufactured fishery products of the state for the year 1919 (see p. 96). Through the cooperation of the packers throughout the state it has been possible to get out the annual pack more promptly as well as more accurately and in greater detail than ever before.

The total case pack of canned goods in 1919 was a trifle over 42,000 cases less than in 1918, while the estimated value of the 1919 pack is nearly $3,000,000 greater than estimated value of the 1918 pack.

During 1919 the tuna, albacore and skipjack pack was larger than in the previous year, and while the actual case pack of sardines for 1919 was less than for 1918, the pack was of a better quality. During 1919 there were only 41,373 round cans of sardines packed as compared to 420,905 cases of round cans for the year previous.

The pack of mild cured salmon for 1919 was nearly double that of the previous year. The production of meal and oil also shows a large increase. At the close of 1919 we find an increase of twelve plants, 203 employees and over $2,000,000 in valuation of plants, which shows the healthy growth of the fish packing industry of California.—S. H. D.

SPORTSMEN LAND MANY BIG FISH.

The total number of blue-fin and yellow-fin tuna taken at Catalina Island during 1919 was 911, of which 36 weighed over 100 pounds each. The total number of marlin swordfish was 114. No broadbill swordfish were captured, but a number of anglers reported unsuccessful battles with them. The prize for the world's tuna taken on light tackle went to Commodore James W. Jump, the fish caught weighing 145½ pounds. The usual awards have been made by the Tuna Club, prizes now being offered for such other game fish as swordfish, white sea bass, bonito and dolphin.

FOREST OFFICERS TO ACT AS GAME WARDENS.

By an agreement recently signed by the Executive Officer of the California Fish and Game Commission and the United

States Forest Service, forest rangers will act as fish and game wardens and deputy fish and game commissioners as forest firewardens. According to the terms of the agreement forest officers will enforce fish and game laws, make arrests, submit reports and issue hunting and fishing licenses. The force of game wardens will therefore be greatly augmented and better enforcement of the fish and game laws is a certainty. The news that forest officers will handle hunting and fishing licenses will be received with pleasure by sportsmen because of the added convenience. The help of the Forest Service in better posting state game refuges will be another outcome of the cooperation planned. In return for the services of the forestry men, the game wardens of the state will be deputized as forest firewardens and will help in protecting the forests and in developing the right public attitude toward the laws and regulations of the national forests. There is to be a continuance of the annual reports on game conditions in the forests furnished by the District Forester.

This cooperation, which has been carefully worked out between the United States Forest Service and the Fish and Game Commission, will make violation of the fish and game laws doubly difficult and will do much to develop a sentiment favoring game conservation. There follows the agreement in full:

AGREEMENT.

In order to secure closer cooperation with the Fish and Game Commission, the following informal agreement has been executed:

Whereas, the wild life on the national forests of California is a product of the forest and a great resource, which adds materially to enjoyment of the national forests by the public, as well as of great economic value, its protection and perpetuation becomes a public necessity; and

Whereas, the Fish and Game Commission of California is the duly authorized agent for the State of California for the protection and perpetuation of this resource, and the District Forester of the Forest Service, United States Department of Agriculture, for the Department; now, therefore

In order to coordinate the work of these departments in the protection of game, fish, birds, and forests of California, Paul G. Redington, District Forester, for and on behalf of the United States Department of Agriculture, and Carl Westerfeld, Executive Officer of the Fish and Game Commission of California, for and on behalf of the State of California, do agree as follows:

1. That under the state laws no differentiation can be made between violators of the law. The law, therefore, should be enforced equally as to all violators.

2. The forest officers, because of their familiarity with the areas on which a large proportion of the wild life in the state exists, can and should assist, by their own personal actions and attitude, in securing the proper respect and enforcement of the state game laws. All forest officers who, in the judgment of the District Forester, can, because of the character of their work, be of assistance in the enforcement of the state fish and game laws, will be appointed by the Fish and Game Commission of California as deputy state game wardens. All forest officers so appointed shall assume the following prescribed duties:

(*a*) Pay strict attention to the enforcement of the state fish and game laws, and by personal actions and attitude assist in creating the right public attitude and sentiment toward the protection of fish and game within the boundaries of national forests;

(*b*) Report all cases of violations of the fish and game laws to the officer's immediate supervisor, who will in turn report the violation to the Fish and Game Commission of California, San Francisco, California;

(*c*) Make arrests for violations of the fish and game laws committed within the boundaries of the national forests;

(*d*) Furnish all information available which will assist officers of the state in apprehending or prosecuting violators of the fish and game laws, whether such violation was committed within or outside the national forests;

(*e*) Submit such reports as may be called for by the District Forester;

(*f*) Report misconduct or dereliction of duty on the part of any state official employed in the enforcement of the state fish and game laws;

(*g*) Issue hunting and fishing licenses, receiving therefor the commission allowed by law.

3. The District Forester will cause an annual report to be submitted to the Fish and Game Commission which shall contain complete information as to the present condition of wild life in the national forests, and plans for the protection and development of fish and game therein. He will recommend the establishment of such game refuges as seem necessary, the boundaries of which shall not be changed without his approval.

4. The Fish and Game Commission of California will elect a representative of its commission to act on behalf of the Commission with the District Forester on all matters pertaining to fish and game work on the national forests of California.

5. The duly authorized agent of the Commission shall have power to act upon all reports and requests from the District Forester, furnish upon requisition the number of fish plants necessary to stock streams within the national forests, provide proper facilities for transport to places of destination, and properly supervise shipment from hatchery to nearest railroad point; and shall issue proper instructions to forest officers designated to transport fish from railroad point to streams, giving at least two weeks' advance notice of date of arrival.

6. Upon recommendations from the District Forester, deputy game wardens will be appointed state fire wardens, and the Commission or its duly authorized agent will instruct such wardens to cooperate with the Forest Service in the suppression and prevention of forest fires.

7. All deputy game wardens will pay strict attention to the enforcement of state fire laws, familiarize themselves with the regulations governing the use of the national forests, and by personal actions and attitude assist in creating the right public attitude and sentiment toward these laws and regulations.

8. Deputy state game wardens will report, through the State Fish and Game Commission, any misconduct of forest officers on the dereliction of duties in the enforcement of fish and game laws.

9. The Fish and Game Commission will provide the necessary signs, labor, and material, for the proper posting and supervision of existing state game refuges or those which may hereafter be established within or adjoining the national forests.

10. Necessary expenses of forest officers in the investigation and prosecution of fish and game violations will be paid by the Fish and Game Commission upon properly certified accounts on forms furnished by the Commission.

11. Amendments to this agreement may be proposed by either party upon giving thirty days' notice to the other. Amendments shall become operative immediately after they have been adopted by both parties.

12. It is mutually understood and agreed that this agreement shall terminate at the end of any fiscal year in the event that Congress shall fail to make an appropriation for the ensuing fiscal year.

BIRD PROTECTION SOCIETIES.

Due credit must be given associations of bird lovers, such as the Audubon societies, for initiating many of the campaigns which have brought about better protection for wild birds. The National Association of Audubon Societies was the pioneer in the establishment of reservations where birds are protected the year round. The laws protecting the sale of bird plumage were also initiated by the National Audubon Association.

There are at present in the State of California two active bird organizations of this type, the California Audubon Society, with a large membership in Southern California, and the Audubon Association of the Pacific, with a membership in the San Francisco Bay region. The latter organization, which is but a few years old, has been doing some splendid work among juveniles by organizing junior Audubon societies and by stimulating bird study among the Boy Scout organizations. It is also actively carrying on an educational campaign through the medium of a small monthly periodical known as "The Gull," which is now in its second volume. Besides conveying information regarding the monthly meetings and monthly field trips, "The Gull" has contained a number of interesting articles relating to bird protection and many notes of the occurrence of rare species of birds. This latest addition to organized bird study, the Audubon Association of the Pacific, under the active leadership of its president, Mr. C. B. Lastreto, is carrying out both lines of endeavor expressed in its aims—the study and protection of birds.

GAME ABUNDANT IN EARLY DAYS.

In an article appearing in "The Auk," volume 37, page 35, entitled "In Memoriam: Lyman Belding," Dr. A. K. Fisher says of this pioneer ornithologist, in connection with the subject of the abundance of game in California in early days:

> He went to Stockton in March, 1856, and of game seen here and in other parts of California he says: "Game was abundant, including elk, antelope, deer, bear, otter, quail, and waterfowl. Elk have disappeared from the interior valleys of the state excepting a drove on the Miller and Lux Ranch of forty thousand acres in the San Joaquin Valley, and these animals are being captured and distributed to various parks. The elk of this state inhabited the tule marshes mainly, though I have seen many elk horns in the Marysville Buttes, probably left there by elk which came from the marshes of Butte Creek, and I have seen hundreds, if not thousands, of elk horns on the border of the tule swamps north of Stockton. Antelope have entirely disappeared from the Sacramento and San Joaquin valleys. I saw three in the latter valley a few miles west of Princeton in the summer of 1870 and a single one in

Lower California about twenty-five miles south of Tia Juana in the spring of 1887. Deer were mostly in the mountains, with a few along the rivers where there were extensive thickets on bottom lands. They will continue to be common with proper protection."

SURE PUNISHMENT METED OUT TO VIOLATORS OF MIGRATORY BIRD TREATY ACT.

There was a time when violators of the migratory bird treaty act depended upon escaping punishment through a trial in their own county by a jury often composed of friends and acquaintances, under which procedure dismissals reached a large percentage of the number of arrests. However, this is all changed now; for since July, 1918, the power to enforce this law has been vested in the Bureau of Biological Survey, of the United States Department of Agriculture, and instead of a trial in the state court in his own county, the violator is brought into the federal court, where, removed from his sphere of local influence, he meets certain punishment. Here in California, in the district known as the "duck country" of the Sacramento Valley, composed of the counties of Yolo, Sutter, Glenn, Colusa and Butte, prior to 1918 the number of dismissals reached about sixty per cent of the number of arrests. But in that year the arrest and conviction in the federal court of four of the most persistent violators with a substantial fine of $100 each, produced a very depressing effect upon chronic violators, and the sentiment has changed to such an extent that the violator usually begs to be allowed to plead guilty in the state court rather than be taken before the federal authorities. This certainty of punishment of violators, in the "duck country" alone, resulted during the period from October 6, 1918, to January 31, 1919 (almost four months), in 20 arrests, *no* dismissals, and fines aggregating $705; and during the period from October 15, 1919, to December 6, 1919 (less than two months), in 23 arrests, *no* dismissals, and fines aggregating $625. At first glance, owing to the greater number of arrests recorded for the latter period, it might seem that violations were on the increase during 1919, but this is not necessarily true. When it is remembered that since 1918 all United States deputy wardens also became state deputies, the increase in the number of arrests can no doubt be traced to the fact that the patrol service has become greatly augmented and more violations detected.

And it is not only in California that the migratory bird treaty act is being more stringently enforced. Five hundred dollars, the maximum fine, was recently levied by a judge in Michigan against a hunter for selling thirty-two ducks in violation of the act. Another violator of the same law, in Connecticut, who had been guilty of repeated offenses, was sentenced to three months in jail. This offender was not given the alternative of paying a fine. This growth in the number of convictions and enlargement of fines through the country shows the increasing concern with which the courts regard violations of this important statute, designed to protect migratory, insectivorous and nongame birds.

NAVAL AIR STATION FISH PATROL OPENS IDLE CANNERIES.

It will be of interest to know that the fish canneries of Southern California had been idle for four months until the inauguration of the Naval Air Station Fish Patrol. This service was instituted during the latter part of December, 1919, in accordance with an agreement between the Naval Air Station at San Diego and the Fish and Game Commission, whereby seaplanes were to sight schools of fish, wire back the direct location to the naval station, which then would telephone the information to the San Diego office of the Fish and Game Commission, which office in turn would immediately notify all canners and fishermen.

As a result of the first day's radio report locating schools of sardines, fishing fleets were able to procure large quantities of sardines, and since that time have been canning continuously, despite the fact that canneries previously had been idle for four months. Everyone interested in the industry is aware that the best and finest fish are found in deep waters, and fishermen hesitate going to uncertain fields on account of loss of time. But now the seaplane locates the schools and they are no longer a prospect, but a certainty.

Genuine sardines are found only in California waters and those of Southern Europe, and the industry in California has made great progress in the past three years and bids fair to become the sardine canning center of the world. And now with the immeasurable value of the Naval Fish Patrol service a proven fact, it would seem that nothing could stand in the way of this development. And although the seaplanes have been so successful in locating schools of sardines, it is anticipated that they will be of still greater value in locating schools of large fish such as tuna, albacore, yellowtail, amberfish, etc., which are found farther from shore and run from early spring to late fall.

Reports of some of the flights made have revealed to canners the fact that seaplane service is really of as much a necessity to the fish and canning industry as fishing fleets or canning machinery, and it is the concensus of opinion that this fish patrol service must be continued. Here are a few of the reports:

I. Installed in cockpit--Hydroplane H. S. 2 L., as observer, Lieutenant E. P. McKellar, pilot. Third occupant, wireless operator. Took flight promptly 2 p.m. Followed leading hydroplane containing Lieutenant Linkins as official observer. Atmosphere fairly clear—slight haze, no clouds, sun rays direct, fairly stiff wind. Judged altitude plane our flight five to seven hundred feet. Altitude leading hydroplane considerable less. Flew north-northwest to area four, square seventy-three, which is west by north, off the coast of La Jolla about five miles and about twenty miles from San Diego by direct line. In this area of approximately ten miles square, we covered the course in serpentine fashion from south to north and return, from east to west and return. Neither on our flight to this area, nor in this area, did either crew discover a school of fish.

II. In this area, however, saw on four separate and distinct occasions, at intervals and in different locations, one single fish on each occasion. From our altitude, their depth in the water could not be definitely determined, nor could the size or species. Taking into consideration the effect of light upon and through water, the magnifying effect of clear water, the silvery scintillating sheen of fish scales on a moving object in clear water on a bright day, subtract our elevation; concluded these fish to be medium sized bass or yellowtail, although the perspective of distance made them appear in the size of a large sardine.

III. The area thoroughly patrolled, we followed the leading hydroplane east by south to the shore line above and off the coast of La Jolla. In the cove off La Jolla the leading hydroplane sighted three small schools of sardines. The information was immediately radioed to North Island, and all canneries had the benefit of this discovery within ten to twenty minutes thereafter.

IV. Still following the leading hydroplane, which was flying low, we proceeded east by south, following the shore line about one-quarter to three-quarters of a mile off shore; our altitude about 600 feet. Here we were again forcibly impressed by the discovery of the intense visibility possible from this height, to the depths under the surface of the water. The topography of the bottom of the ocean was plainly and distinctly clear to vision, as well as all plant life and formations, this being in many instances three-quarters of a mile off shore. The depth of the water we had no way of estimating, but to hazard a guess would say it was anywhere from forty to sixty feet in depth.

V. We crossed the channel and entrance to San Diego Bay, continuing flight over a great portion of Coronado Bay, where again were impressed with the intense visibility through this water, which is not nearly as clear as the pure ocean streams and currents. Regardless of its muddy and murky appearance, it was possible to see the bed of that bay for great distances. The value of this fact should immediately impress itself on one; for this bay is one of the largest and most favored feeding grounds of the sardine when in season.

VI. We proceeded, returned to our starting point at 4 p.m., elapsed time, two hours.

FACTS OF CURRENT INTEREST.

Two Italians of Thornton, San Joaquin County, were recently arrested for using a gill net on the Mokelumne River, where such fishing is illegal. These men pleaded guilty in court on January 29 and were fined $250 each by Judge Barber.

* * *

During the season of 1919, 30,836.000 fish, mostly salmon and trout, were reared and distributed from the twenty-two hatcheries and egg collecting stations operated by the California Fish and Game Commission.

* * *

State Lion Hunter Jay Bruce has been successful in reducing the number of lions in the large game refuge in Santa Barbara and Ventura counties.

* * *

Beavers have become so abundant on the Merced River near Snelling that damage to agricultural interests have resulted and special permission has been granted to the parties injured to reduce their number.

* * *

Whistling Swans (*Olor columbianus*) have again been numerous in this state the past winter (1919-20). Although frequenting the fresh waters of the interior valleys as a rule, this year they have been seen in considerable numbers in Bodega and Tomales bays and at the mouth of the Salinas River.

* * *

Of the 4500 commercial fishermen in California 29 per cent are natives of Japan, 27 per cent are natives of the United States, and 26 per cent of Italy.

* * *

Despite the fact that the whale is a mammal and not a fish, the Board of United States General Appraisers have decided in a test case that canned whale meat is fish and is subject to duty.

* * *

Although large numbers of herring were captured in Richardson's Bay last year (1919) and canned at Pittsburg, thus far this year they have failed to appear.

* * *

The American merganser has been reported in unusual numbers at numerous places along the Californian coast. Specimens have been taken at San Diego, and large numbers seem to be wintering in certain localities in San Francisco Bay, as for instance, near San Rafael.

HATCHERY NOTES.

W. H. SHEBLEY. Editor.

FISH DISTRIBUTION, 1919.

During the season of 1919 the operations of the Department of Fishculture were more extensive than during any previous year of the Department's activity. The actual number of fish distributed was not as great, perhaps, as during some of the past years, but the fry were given a more careful and a wider distribution than ever before.

The procedure of distribution of fish by the fish distributing cars previously has been to deliver the fish to the various applicants at the designated railroad station, and for the applicants to attend to all of the work of actually planting the fish. In a great many instances this plan resulted in more or less serious losses of fish due to the inexperience of those handling them. A plan was adopted this season whereby a trained assistant was detailed to leave the fish car at the point of delivery and assist the applicants in planting the fish. Necessarily, it was not possible for a special messenger to accompany every lot of fish planted, but an effort was made to send someone with every large consignment, where the transportation and planting of the fish was at all difficult and when the applicants were inexperienced in fish planting.

Many of the applicants, who have been receiving trout fry from the Commission for planting in different sections of the state for several years past, are experienced in the work and no assistance from this Department, in the actual planting work, is necessary. In order to carry on this work it was necessary to employ several extra messengers for the distribution cars, but it is felt that the results obtained fully justify the extra expense.

The accompanying table shows the distribution of the different species of trout fry and salmon from the various hatcheries.

It will be noted that fish were distributed from sixteen hatcheries. In addition to these hatcheries six egg collecting stations, from which no distribution of fry was made, were operated. Thus it will be seen that altogether during the season of 1919 the Department of Fishculture operated twenty-two hatcheries and egg collecting stations and distributed in the waters of California 30,836,000 fish.

Fish Distribution, Season 1919.

Hatcheries	Rainbow	Eastern Brook	Loch Leven	Black Spotted	Steelhead	Golden	Brown
Bear Lake	748,000						
Brookdale					849,000		
Clear Creek	157,000						
Domingo Springs	220,000				116,000		
Fall Creek	670,000						
Fort Seward	234,000	8,500			538,000		
Kaweah	239,500			46,000	98,000		
Mount Shasta	2,468,500	1,070,000	2,746,000	87,000	1,411,500		320,000
Mount Tallac	51,000			685,000	185,000		
Mount Whitney	1,023,000	93,000	136,000	402,000	474,000	450,000	
North Creek	810,000						
Snow Mountain					250,000		
Tahoe	96,000			351,000		234,650	
Ukiah					600,000		
Wawona	155,000				100,000		
Yosemite	191,500			99,700	96,600		
Totals	7,063,500	1,171,500	2,882,700	1,670,700	4,718,100	684,650	320,000
Grand total, trout							18.510,450
Grand total, salmon							12,326 200
Total of grand totals							30,836,650

Furthermore a great deal of construction and improvement work was undertaken at the various stations and under favorable climatic conditions, during the coming season more trout and salmon fry than has ever before been possible can be handled. This will make it possible to meet the ever growing demand for more and more fish for stocking the streams and lakes of practically every section of the state.

MOUNT SHASTA HATCHERY.

A total of 8,102,000 trout fry were distributed in streams of northern and central California from the Mount Shasta Hatchery during the season by the two fish distributing cars. The work of distributing the fish was carried on from June 23, when the first carload left the hatchery, until October 11, when the last of the fry were planted.

In addition to the propagation of trout at the Mount Shasta Hatchery, the salmon cultural operations were given careful attention this season. The take of quinnat salmon eggs at the United States Bureau of Fisheries stations at Mill Creek and Battle Creek was not as large as had been expected, and therefore as great a number of eggs as usual was not received. The take of eggs at our own Klamathon egg collecting station, located on the Klamath River, was also small. Especial attention was given the fry resulting from the eggs received. The fish were fed and held in the hatching boxes as long as it was possible to give them the proper attention and 6,593,000 were then planted in the upper reaches of the tributaries of the Sacramento River in the vicinity of Sisson, from February 28 to May 13, as conditions for their liberation were favorable.

Three and one-half million salmon fry were then transferred to our three large salmon rearing lakes where they were retained throughout the summer. They developed rapidly under the favorable conditions obtaining therein and when they were liberated, during the latter part of October, they were in perfect condition to commence their long journey to the sea.

Since the construction of hatchery A, the main building at the Mount Shasta Hatchery, in 1909-10, the hatchery troughs have never been renewed. Many of them were in very poor condition, and it was deemed absolutely essential, that the old boxes be removed and new ones put in. Accordingly the materials were ordered and on the ground by the time the last of the fish were taken out and the construction and installation of the new troughs was immediately commenced. The crew has been engaged in this work practically all winter and by the begin-

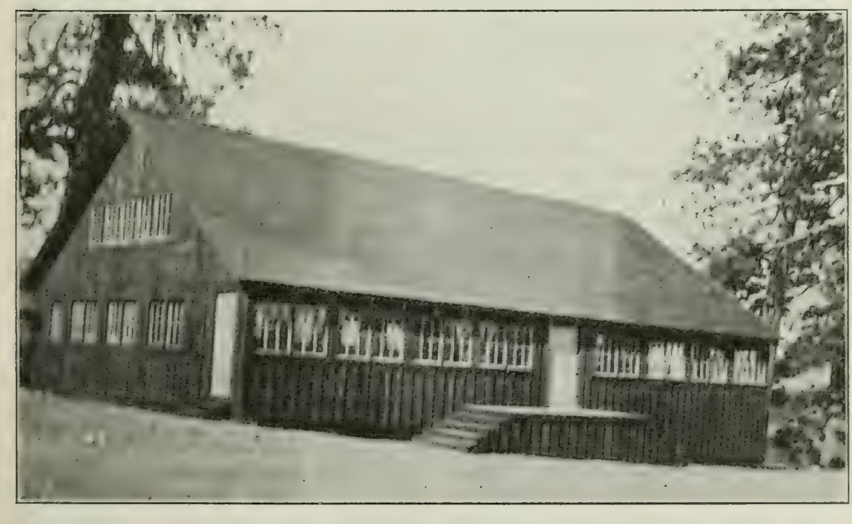

FIG. 26. Bear Lake Hatchery, San Bernardino County, California. Photographed by M. K. Spaulding, November, 1919.

ning of the 1920 fish cultural season the new troughs will be ready for the reception of the eggs. Various other repairs to buildings and grounds have been made during the fall and winter months, and all is in readiness for the beginning of the season's operations.

KLAMATHON STATION.

During the late summer of 1918 the Klamathon egg collecting station was taken over by the California Fish and Game Commission from the United States Bureau of Fisheries and arrangements were made to operate the station that fall. Over one million eggs were taken and these were immediately shipped to the new Fall Creek Hatchery.

During the fall of 1919 this station was prepared to operate at full capacity. Nearly five million eggs were taken despite the extreme drought, which materially affected the run of quinnat salmon in the Klamath River. Had we received the usual amount of rainfall in that section during the months of October and November, the take of eggs would have been greatly in excess of the number obtained. The eggs were transferred immediately after spawning to Mount Shasta and Fall Creek hatcheries.

FALL CREEK HATCHERY.

Fall Creek Hatchery was operated for the first time during the season of 1919. The quinnat salmon eggs received from the Klamathon Station were hatched and reared to a suitable age, when 500,000 were distributed in Fall Creek, a tributary of the Klamath River, during the month of May. The balance of 650,000 were held in the rearing ponds throughout the summer and distributed during the months of September and October. These fish, like the ones retained in the salmon lakes at the Mount Shasta Hatchery, were in excellent condition when planted.

BOGUS CREEK STATION.

All of the rainbow trout eggs taken at Bogus and Camp creeks were "eyed" at the Fall Creek Hatchery. Seven hundred thousand were hatched at this station and reared for distribution in tributaries of the Klamath River, both above and below the dam of the California Oregon Power Company, at Copco. The balance of the "eyed" eggs were shipped to the Mount Shasta Hatchery.

COTTONWOOD CREEK STATION.

During the spring of 1919 the Cottonwood Creek egg collecting station near Hornbrook was operated and an extensive survey made of the creek with reference to the run of rainbow trout ascending the stream to spawn, with the idea of installing more suitable and permanent equipment for egg collecting operations. The investigations and the result of the season's operations demonstrated the value of the site, and accordingly a suitable lease was arranged and adequate facilities for handling the spawning trout during the coming spring installed.

MOUNT WHITNEY HATCHERY.

The operations at Mount Whitney Hatchery for the season were brought to a close during the latter part of October. On September the first, fish distribution car No. 01, was detached from fish distributing work at the Mount Shasta Hatchery and commenced the distribution from Mount Whitney Hatchery. The waters of Southern California were practically all stocked from the Mount Whitney Hatchery this season. Consignments of fish were shipped to Fresno, Inyo, Kern, Los Angeles, Madera, Mariposa, Mono, Riverside, San Diego, San Luis Obispo, Santa Barbara, Tulare and Vantura counties. This was the most extensive distribution ever made from the Mount Whitney Hatchery.

Cottonwood Lakes station was operated and a new record was established for that station, 965,000 golden trout eggs being taken. All of the eggs were immediately transported by pack train over the mountain passes to the Mount Whitney Hatchery as soon as they were spawned, where they were "eyed." A large consignment of the "eyed" eggs was shipped to the Tahoe Hatchery and the balance were hatched and reared for distribution in the streams and lakes of the High Sierras, which were suitable for them.

Two and one-half million trout fry were distributed from Mount Whitney Hatchery this season. All of the fry planted were fine, large fish and the results of the season's planting to the waters of southern California should be productive of some excellent fishing for the sportsmen during the coming year.

TAHOE HATCHERY.

The hatchery at Tahoe City received shipments of rainbow, black-spotted and golden trout eggs from the various egg collecting stations and a total of over 650,000 fry, of these three species, were distributed in the water of the Tahoe Basin and other streams of El Dorado, Nevada and Sierra counties. During the month of October a consignment of 25,000 golden trout fry were shipped to the Yosemite Valley from Tahoe Hatchery.

MOUNT TALLAC HATCHERY.

The egg collecting operations at Mount Tallac Hatchery last spring were not as successful as usual, owing to adverse conditions of weather at Lake Tahoe during the early spring months. The crew reached the spawning station during the middle of March, but it was April 14th before the first eggs were taken. Two million black-spotted trout eggs were taken during the season and these were "eyed" and shipments of eggs were sent to Mount Shasta, Mount Whitney, Tahoe, Kaweah and Yosemite hatcheries. Nearly 700,000 black-spotted eggs were hatched at the Mount Tallac Hatchery and were distributed together with rainbow and steelhead trout fry in the waters of Alpine, El Dorado and Placer counties.

FORT SEWARD HATCHERY.

A million quinnat salmon eggs were hatched at Fort Seward Hatchery during the spring of 1919 and the resulting fry were distributed in the Eel River and tributaries, Mad River and the tributaries of Humboldt Bay. Rainbow, eastern brook and steelhead trout eggs were shipped to the Fort Seward Hatchery during April and May and these were hatched and reared during the spring and early summer months. A total of 770,000 trout fry were distributed in the streams of Humboldt and Trinity counties during July and August.

As soon as the fry were distributed extensive improvement work at the station was commenced. The site of the hatchery is very isolated and great difficulty has been experienced in keeping assistants employed at the station. The living quarters for the men have been very poor and it was essential that something be done to improve conditions, if the station was to be kept in operation. Accordingly arrangements were made to improve the superintendent's dwelling and two plain, but comfortable, little cottages were put up for the assistants and equipped with necessary furniture for housekeeping.

UKIAH HATCHERY.

A larger number of steelhead trout fry were reared at Ukiah Hatchery for distribution in the streams of that section than have been handled during former seasons. A total of 600,000 trout fry were distributed in Mendocino and Sonoma counties during the summer. In the spring months practically all of the eggs taken at Snow Mountain Station were "eyed" at Ukiah and the results obtained were very satisfactory.

SNOW MOUNTAIN STATION.

During the spring of 1919, 5,400,000 steelhead trout eggs were collected at the Snow Mountain Station. Had it not been for the failure of the water supply and inadequate facilities for handling spawning trout in the holding pens in the late spring, when the water became very warm, a much greater number of eggs could have been taken. A quarter of a million steelhead eggs were hatched at the Snow Mountain Station and distributed in the tributaries of Eel River. During the past month a crew of men at the Snow Mountain Station have been engaged in building new holding pens and making improvements and repairs to the station, that will improve the handling of the fish during the coming season.

BROOKDALE HATCHERY.

Brookdale Hatchery was operated the same as usual during the season of 1919, the steelhead eggs received from Scott Creek being "eyed" for shipment to other stations, with the exception of 850,000 fry, which were hatched and planted during the summer months in Monterey, San Mateo, Santa Clara and Santa Cruz counties.

SCOTT CREEK STATION.

The total take of steelhead trout eggs was only 1,750,000 at Scott Creek during the season of 1919, owing to the drought, which seriously interfered with the extent of our operations in that section. As stated above the eggs were all sent to the Brookdale Hatchery, where they were "eyed" for distribution to various other hatcheries.

ALMANOR HATCHERY.

Two hundred thousand rainbow trout eggs were taken at the Almanor dam of the Great Western Power Company last season, but the water supply for the hatchery failed early in the season and it was necessary to transfer all of the eggs as soon as they were properly "eyed" to the Clear Creek Hatchery near Westwood.

DOMINGO SPRINGS HATCHERY.

Nearly a million rainbow trout eggs were taken at Domingo Springs Station during the season and consignments of "eyed" eggs were shipped to Mount Shasta and Wawona hatcheries. The rainbow and steelhead trout fry reared at the Domingo Springs Station were given a very wide distribution in streams and lakes of Lassen, Plumas and Tehama counties. An auto truck was used for a great part of the distribution and the United States Forest Service at Mineral cooperated in the work of giving the fish a wide distribution. After the fish were all planted very extensive improvements were made to the station and an auxiliary egg collecting station was established at the mouth of Warner Creek. If conditions are favorable during the coming season for egg collecting operations in that section, a much larger take of eggs can be looked for than has ever before been obtained.

CLEAR CREEK HATCHERY.

The rainbow trout eggs received at Clear Creek Hatchery from the Almanor Hatchery were hatched and distributed in the streams and lakes in the vicinity of Westwood, Lassen County. It was the first season this station was operated and the results obtained were satisfactory in every respect. After the fish had all been distributed many little repairs and improvements were made and racks and trap were installed in the creek beside the hatchery. A holding pen for the spawning trout was also constructed and during the coming season an effort will be made to collect eggs from the rainbow trout running up Clear Creek to spawn.

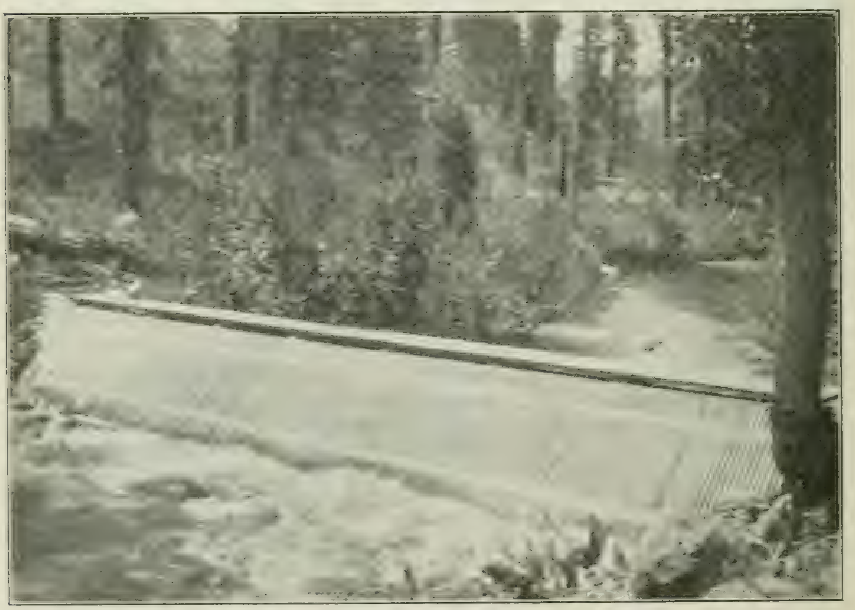

FIG. 27. Fish rack on Warner Creek, Plumas County, California, where many trout were taken for spawning purposes this past year. Photographed by M. K. Spaulding, September, 1919.

BEAR LAKE HATCHERY.

Nearly 5,000,000 rainbow trout eggs were taken at North Creek Egg Collecting Station during the season of 1919, despite the inadequate facilities to handle the work. It was demonstrated that to take advantage of the wonderful possibilities for the collecting of rainbow trout eggs at Bear Lake it was essential that very extensive improvements be made in order to handle the spawning fish properly, that suitable hatchery buildings, properly equipped, be provided at both North Creek and Green Spot Springs, and most important of all, that adequate living accommodations be provided for the foremen and assistants at both places. It is not possible to obtain satisfactory results from a station where the egg collecting paraphernalia is inadequate for the requirements, and poorly constructed; where the hatching troughs are covered only by canvas and where the foremen and assistants in charge of the work are compelled to live at an altitude of 7000 feet above sea level, in a land of deep snow and freezing weather, with only small tents for living quarters. It is neither fair to the men nor to the work to operate under such conditions. Accordingly, as soon as the fish were distributed, a crew of men was put to work on the various creeks flowing into Bear Lake. The beds of the streams were cleaned up and passageways were cut to enable the spawning fish to enter the creeks through the sand bars. Checks were made, racks and traps constructed, and cabins built for watchmen and trap tenders.

The hatchery buildings at North Creek and Green Spot Springs were put in first class shape and suitable living quarters were constructed for the foremen and assistants. The stations are now in excellent condition for the coming season's work, and if there is sufficient snow and rainfall in that section this season, the take of eggs will undoubtedly break all past records.

KAWEAH HATCHERY.

To keep up with the demands of the applicants of Kern, Fresno and Tulare counties for trout fry for the streams of that section, it was decided to establish an experimental hatchery to ascertain the suitability of the water for hatchery purposes. A site was selected near the town of Hammond on the Kaweah River, on one of the main highways. Rainbow, black-spotted and steelhead trout eggs were shipped to the hatchery and the fry hatched were given the very best attention throughout the spring and summer months, careful records being made of water temperatures. The fry reared were strong and healthy and attained a very good size. Three hundred and eighty thousand trout were hatched, reared and planted in the tributaries of the Kaweah River and other streams in that section during the summer. All arrangements have been made and plans drawn for a good-sized hatchery building to be constructed this spring, providing that a satisfactory lease can be obtained for a hatchery site.

WAWONA HATCHERY.

Wawona Hatchery was again operated during the past season. Rainbow and steelhead eggs were shipped in from other stations and a quarter of a million fry were distributed in the streams of Madera and Mariposa counties during the early summer months.

YOSEMITE HATCHERY.

The experimental station located at Happy Isles in Yosemite Valley was operated during the summer. Rainbow, black-spotted and steelhead trout eggs were shipped in from other stations, and the fry resulting therefrom were successfully reared to a good size and were given an extensive distribution in the streams and lakes in the Yosemite Valley, with the cooperation of the officials and employees of the Yosemite National Park. The site was demonstrated as being satisfactory for hatchery purpose, but as it is against the policy of the state to erect permanent buildings on leased land it was decided at a meeting of the Board of Fish and Game Commissioners, held during the latter part of October, to abandon the project. All equipment was therefore removed from the site and transported by auto trucks to the Wawona Hatchery, where it has been used to equip that station for more extensive operations.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor

INVESTIGATION OF HALIBUT FISHERIES PROPOSED.

In the proposed treaty between the United States and Canada to regulate and conserve the halibut fishery it is provided that inhabitants of either of the two countries may not fish for halibut in the North Pacific Ocean from November 16 to February 15, both dates inclusive, this closed season to continue in effect until February 15, 1930. It also provides that the two governments shall cause to be made a thorough joint investigation into the life history of the Pacific halibut. The International Fisheries Commission, appointed by the two governments in 1919 for the protection and rehabilitation of the salmon fisheries of the Fraser River and Puget Sound, is charged with the supervision of the halibut investigation.

It was conclusively shown some six years ago by Mr. W. F. Thompson, who made an investigation of the halibut fishery for the government of British Columbia, that the known halibut banks were being depleted at an alarming rate. This was clearly shown by a decided decrease in the catch per unit of fishing gear and by a marked reduction in the catch of large fish. Since that time the total catch has declined rapidly and it does not need a life history investigation to show that the halibut fishery of the North Pacific is well on its way to commercial extermination. An investigation of life histories is well enough and a necessary part of such an investigation, but it is more important to institute a system of gathering accurate statistics of the catch. We have been slow in learning that the basis of fisheries conservation work must be accurate and complete data of the catch. It strikes us that the two governments are about six years late in starting and that the short winter closed season, during the time the catch is always very light, is totally inadequate.

SLEEPER SHARK CAPTURED.

A sleeper shark, known to ichthyologists as *Somniosus microcephalous* was taken in one of the A. Paladini Company's trawl nets while fishing off Point Reyes on February 26. The length of the fish was only seven feet, which is considered small, as sleeper sharks reach a length of twenty-five feet. The event was not remarkable in the fact that a shark was taken in a trawl net, for the trawl nets catch large numbers of sharks, but in the fact that this is the first sleeper shark that has ever been recorded from California. This adds one more species to the list of nineteen sharks found in California as given by Professor E. C. Starks in October, 1917, and January, 1918, issues of this magazine.

The sleeper shark may be known from the other sharks by the absence of an anal fin and by the absence of a spine at the front of each of the two dorsal fins. This sluggish and clumsy looking shark is commonly found in the Arctic regions and extending down the Siberian coast to Japan and down the west coast of North America to Puget Sound. It is found commonly about Greenland and south to Cape Cod and France. On our New England coast it is known as the gurry shark from its habit of eating fish offal. In Alaska it frequents the region of the salmon canneries where it eats the fish offal thrown away at the canneries. It is reported as attacking whales in a ferocious manner, biting chunks from their hides.

MARKING SOCKEYE SALMON FRY.

The United States Bureau of Fisheries is marking yearling sockeye salmon fry at their Bonneville Hatchery in Oregon. These fry, hatched from eggs obtained at the salmon hatchery at Afognak, Alaska, will be liberated in the Columbia River and a watch kept for their return to the stream to spawn three years hence. A few years ago the Bureau marked and liberated, in the Columbia River, sockeye fry which were hatched from eggs taken at Yes Bay, Alaska. These fry returned at the age of four years to spawn and it was found that they were not like the sockeyes which run naturally in the Columbia River but were like the Yes Bay fish in size and quality, thus proving pretty conclusively that the fish from the two places are not different on account of a difference in the feed in the two places, but for the reason that the sockeyes of the two regions are distinct races and that size and quality are inherited characters. The sockeyes at Afognak are of still another race whose members are smaller of size and of different quality when compared with either the Yes Bay or Columbia fish of the same species. The return of the fish now being marked will be eagerly awaited for the final and conclusive proof that size and quality are inherited characters.

LOW RIVERS INFLUENCE SPAWNING HABITS OF HERRING.

Ordinarily herring which enter San Francisco Harbor in January and February congregate in Richardson Bay and along the lower end of Angel Island, attaching their spawn to the rocks and sea weeds along the shores of Belvedere as well as along the shore of the main land and Angel Island near the lower end of Raccoon Straits. This year, on account of the low water in the rivers, which permitted the salt water to move further up stream than ever before recorded, the herring have for the first time in the memory of the oldest fishermen, deposited their spawn in the upper portion of the harbor known as San Pablo Bay. They attached their sqawn in all suitable places from Point San Pablo to Point Pinole and the schools of herring instead of collecting in Richardson Bay near Sausalito and Belvedere moved on up through Raccoon Straits so that the best fishing was found from Southhampton Shoal to Red Rock.

Very few herring were caught this season in San Francisco Bay for the reason that there was no good demand for them in the markets and under the new law the fishermen were not permitted to catch them for reduction purposes. The San Francisco wholesale markets were not able to dispose of over two or three tons per day. None were salted or smoked as the local demand for salted and smoked herring ended when the saloons closed on July 1. The market for canned herring was off so none of them were canned. Fishermen at the wharf frequently begged for buyers at twenty-five cents per box, and these delicious fish were offered at the fish stalls at from five to seven cents per pound without creating any appreciable demand among those who complain of the high cost of fish. Salmon and striped bass were scarce at the time and extremely high priced, but even that did not help the sale of the cheaper variety.

SALMON PACKERS FEAR SALMON DEPLETION.

With the failure of the sockeye runs in Puget Sound and Fraser River as an object lesson the salmon packers have become alarmed over the future of the salmon industry in Alaska. The interested packers met together and decided something had to be done if the Alaska salmon fisheries are to continue yielding them a profit. A committee was appointed to draft a comprehensive bill for the conservation of the fisheries to be introduced and passed upon by the Congress of the United States. The committee was wisely chosen and is made up of the following members: D. W. Branch of Libby, McNeill & Libby; Carl A. Sutter of the Fidalgo Island Packing Company; Frank M. Warren of Alaska-Portland Packers' Association; Henry O'Malley, Pacific Coast Agent United States Bureau of Fisheries: Dr. C. H. Gilbert of Stanford University; John N. Cobb. Director College of Fisheries, University of Washington; John R. Beegle, of Alaska Fish Commission, and C. D. Garfield, Secretary Alaska Fish Commission. The committee has worked for several months and has finally perfected a bill which is likely to have the backing of the salmon packers, the Alaska Fish Commission, the United States Bureau of Fisheries and all interested in salmon conservation. The main object of the bill is to provide for a larger number of salmon to reach the spawning beds. It also provides for the organization of an Alaska Fish Commission composed of five members to be appointed by the Secretary of Commerce and gives this commission ample power to carry on the conservation work of such a commission. It is estimated that the measures in the bill regulating the fishing seasons and methods of fishing will reduce the salmon catch about twenty per cent.

KAMABOKO BEING MANUFACTURED AT SAN PEDRO.

Among the additions to the fish packing industry at San Pedro Harbor is a plant recently established by Mr. Isona for manufacturing kamaboko. This is a product prepared from white-meated fish by Japanese methods. Barracuda is usually employed in its manufacture but halibut, sea bass and jewfish are sometimes utilized.

Kamaboko is prepared by first removing all bones from the fish and scraping the flesh free from the skin. The meat is then placed in a large, hollow granite bowl where it is ground into a fine paste. Cornstarch, salt, sugar, and the juice made by soaking several fronds of Japanese seaweed (*Arthrothamnus bifidus*) in warm water are added, and the mixture is then moulded into forms and placed on thin wooden blocks about eight inches long. After being steamed for forty-five minutes it is cooled and packed for shipment. For fetes and special occasions the loaves, weighing about one pound, are tinted, red, blue, or green, and resemble very much pieces of pastry. Other forms are moulded and baked or fried in oil without coloring.

The manufacture of kamaboko has developed into quite an industry in Japan, where it is one of the staple articles of food. It is palatable and nutritious and may be eaten as a sandwich filling, or cut into small pieces and added to soups, chowders, or chop suey. The finished product will keep about one week, but plans are now under way to can it for export trade.

The plant at San Pedro has a capacity of approximately five hundred pounds of fish per day. C. S. BAUDER.

Most of those who complain of the high cost of fish know only three varieties—salmon, striped bass and halibut.

* * *

Any official who attempts to satisfy the public on the price of fish has set for himself an impossible task.

* * *

Scarcely one-fifth of California's fish catch goes to the fresh fish markets.

* * *

The wholesale value of last year's fish pack in California exceeded twenty-five million dollars.

* * *

California ranks first among the states in the value of her fishery products.

* * *

If California had depended only on the fresh fish markets its fisheries would now be unimportant.

* * *

The only adequate way to get the public to eat new varieties of fish is to get the fish in cans and give them euphonious names.

* * *

The price of fish does not cut as much figure as the name.

* * *

One of the best food fishes we have in California is the shad, which was introduced some fifty years ago from the Atlantic coast. These excellent fish are now running and are abundant and cheap. We will use less than ten per cent of the catch in this state. The rest will be shipped to Chicago, Boston or New York where they sell readily at three times their price in San Francisco, while we continue to complain of the high cost of fish.

NOTES FROM THE STATE FISHERIES LABORATORY.*

By Will F. Thompson and Elmer Higgins.

A SCIENTIFIC ASSISTANT EMPLOYED.

The Commission has secured the services of Miss Helen M. Edwards as a scientific assistant, commencing January 15. Miss Edwards has had considerable experience as assistant in work of the character now being done by the Commission, having been employed while she was still an undergraduate at Stanford University, by Doctor C. H. Gilbert during his work on the salmon. In addition, she has done scientific drawing, and is a capable stenographer.

W. F. T.

PROGRESS OF THE SARDINE WORK.

Mr. Higgins at San Pedro, and Mr. Sette at Monterey, are engaged under the supervision of Mr. Thompson, in laying the foundation for the future work on the sardine. This preliminary "survey," if such it may be called, consists of a careful and laborious tracing of the character of the sardine "runs" at different times of the year and the ascertaining of the size classes which go to make up the catches. The samples are obtained from the boats as they unload at the canneries, and measurements of length and weight are taken, together with other biological observations on sex and state of maturity. This is expected to give data upon which age may be distinguished, to render it possible to correlate fluctuations in catch with various conditions, to enable the catches of successive years to be compared more accurately from the standpoint of age composition and to indicate the spawning season as nearly as possible. The necessity for such a "survey" and its value in future work have already been amply demonstrated in a number of ways, upon which comment may be expected in the future.

The Commission has been granted the courtesy of accommodations at Hopkins Marine Station, at Pacific Grove, as headquarters for the work being done on the sardine at Monterey, and thanks are due the director, Doctor W. K. Fisher, for his many favors. The work on the sardine is also being carried on at San Pedro, and the Commission is under obligations to the Neilsen and Kittle Canning Company for quarters there. Without their courtesy the Commission would be without adequate facilities for the investigation, as the present laboratory at Long Beach is too distant from the fishery centers.

W. F. T.

OCCURRENCE OF A DEEP SEA FISH AT MONTEREY.

It often happens, especially in deep sea halibut fishing, that cod or halibut trawls are set over water which is too deep, and in such case strange silvery fish are sometimes taken. These fish have snouts projecting in sharp angles beyond the large mouth, their eyes are large, their scales are very rough and silvery, and the body tapers back into a long, thin, pointed tail bordered above and below with fins, but lacking a separate tail fin. These fishes are allied to the cods, and belong to the family Coryphaenoididae. One such specimen was brought into Monterey during January, and preserved by Mr. Oyer, the deputy there. It belongs to the species known as *Nematonurus acrolepis*, one taken in numbers by the United States Bureau of Fisheries' vessel "Albatross" during her work off California, and found along our coasts in depths of 500 and 1500 fathoms as far north as Bering Sea and in Japanese waters. It was entirely unknown to the fishermen, as would be natural considering the depths at which it is usually found. W. F. T.

INVESTIGATION OF THE SALTON SEA.

During the latter part of December, Mr. Crandall of the Scripps Institution, and Doctor H. C. Bryant and Mr. W. F. Thompson of the Fish and Game Commission, visited Salton Sea to investigate the life and the hydrographical conditions of the sea. They were the guests of Captain Davis, who has long been known to the Commission as engaged in shipping mullet from Salton Sea. During the visit, large specimens of mullet were taken by Captain Davis' fishermen, but no other live fish were observed with the exception of two top minnows taken along the shore. These were of a form usually taken in desert springs and streams, *Cyprinodon macularius*. Later Captain Davis sent to Mr. Thompson samples of small fish taken from the vicinity of Fish Springs at the northwestern end of Salton Sea. These proved to be of the same species.

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*California State Fisheries Laboratory, Contribution No. 18.

The existence of the grey mullet in Salton Sea is of considerable interest, as the species must have entered during the inflow of the Colorado River during 1906. If so the mullet must have lived in the Colorado at some distance from its mouth, a fact not strange when the frequent appearance of the mullet in rivers and lagoons bordering our coast is remembered. However, it has taken some time for the species to become abundant in Salton Sea, it having been unrecorded previous to 1915, according to Captain Davis. During the interval it is said that carp appeared in great numbers and then died off. The carp and the mullet are both bottom feeding fish, consuming vegetation, etc., and are not dependent on other smaller fish species. But the mullet is also capable of existing in brackish and salt water—that being its natural habitat in fact—and it is probable that this enabled it to flourish where the carp could not. The ancients used to grow mullet in artificial enclosures, and the flesh was considered a great delicacy.

There are also said to be species of fresh water fish found at times near the outlets of the New and the Alamo rivers, but nothing was seen of these. W. F. T.

THE RECUPERATIVE POWER OF THE ABALONE.

During 1911 Mr. W. F. Thompson carried on a survey of the shell fish of the northern part of the state, and during its course came naturally to handle many specimens of the red abalone, *Haliotis rufescens*. Among these was a specimen remarkable for the evident great recuperative powers. The viscera of the abalone naturally surround the large central muscle in a peculiar way, as a bent cone, and in this case the cone had been cut off by some one attempting to obtain the abalone. The attempt failing, the abalone had evidently succeeded in covering the large mass of dead cut-off parts with pearly layers of shell. But that the animal had been seriously injured could not be doubted, the edge of the shell showing a total cessation of growth for some time previous to death. The shell only was found, the abalone having finally died, possibly as a result of the injury. A photograph of it is presented.

Altered shell formation is not at all infrequent, particularly among clams, where growth is often seemingly totally stopped by some injury, and starts again well in from the former edge. But no instance has ever been seen by the

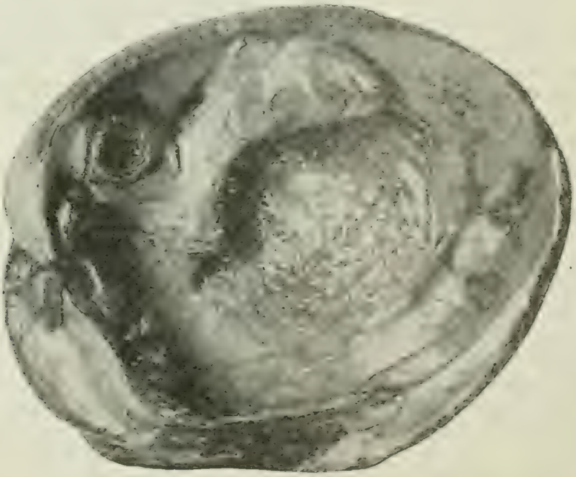

FIG. 28. Shell of abalone (*Haliotis rufescens*) showing part of damaged viscera covered by a pearly layer of shell. Taken near Fort Bragg in 1911.

undersigned where the injury was of such a severe nature as in the case of this abalone, and in which shell formation subsequently proceeded for any length of time. W. F. T.

OCCURRENCE OF THE GREEN ABALONE IN MONTEREY.

Due to the kindness of Mr. Ernest Dalter, who conducts a sea food restaurant in Monterey, it is possible to record the occurrence of the northern "green" abalone, *Haliotis wallalensis*, in the Bay of Monterey. It is undoubtedly a very rare inhabitant of our waters. Mr. Dalter has in his possession a shell of this supposed variety of *Haliotis fulgens* 3¾ inches long. It is hardly to be doubted that it is a distinct species, not a variety of the "green" abalone, the shell much resembling that of the red abalone, never exceeding 5½ inches in length, and usually possessing 6 or 7 open holes. W. F. T.

STREAM POLLUTION IN NEW YORK STATE.

In a recent publication by the Conservation Commission of the State of New York, 1919, Doctor Henry B. Ward of the University of Illinois records the results of his preliminary investigation of polluted streams in New York in their relation to fish life. In this paper he emphasizes the utility of biological work, rather than chemical or bacteriological, in determining the extent of pollution. Bacterial tests are made to determine the effect of the water when used for drinking, but these have little relation to fish life. Chemical tests are of limited use because "we do not by any means always know the effect upon living organisms of a given chemical substance," especially in varying dilutions and relation to other chemicals present. "In order to reach a more accurate measure of the injurious character of polluted waters, one would have to take into account the effects of the prolonged influences of a waste on the fish." The resistance of various species varies widely, as does that of the same species at different seasons. Doctor Ward is plainly of the opinion that "if the character of the water and the bottom have been so modified by the introduction of foreign materials that they no longer afford opportunity for the development of these smaller organisms (food for fish), then by the absence of such forms of life one would demonstrate clearly and positively the fact that water has been rendered unfit for fish existence"—this method to be used, of course, in addition to the observations and tests made directly upon fish themselves.

Californians should be interested chiefly on account of the relation of pollution to salmon and other anadromous fishes, to which the following by Doctor Ward may sometime apply here: "It is hardly a profitable business for the state to raise at such a considerable expense quantities of young fish in order to plant them out in waters in which the chances of existence are unfavorable." Doctor Ward presents a preliminary survey of the water polluted streams, and a series of recommendations, to which the attention of any one interested may be called. He lays much emphasis on the necessity of a careful census, continued study, reclamation of wastes and the education of public opinion to the banishment of wastes from our streams as they have been banished from our streets. There is enclosed with the paper a map showing the great number of establishments in New York from which pollution may be expected.

W. F. T.

GULLS IN MONTEREY BAY.

On account of the fish eating habits of sea gulls, their abundance is a matter of interest to those engaged in the study of fish. At Monterey, where the sardine canneries are located, there are frequently great flocks at rest on the rocks and adjacent quiet waters, which seem to be thickly spotted with the birds as far as the eye can reach. An exceptionally favorable opportunity seemed to present itself on February 17 of this year, 1920, because of the unusual number of birds present, and an attempt was made to estimate the numbers of birds within eyesight of a window in the Hopkins Marine Station. Counting with a field glass it was certain that 3000 were within sight of the naked eye, and it would not be amiss to increase this by another thousand to cover those not seen or in flight. This number, 4000, surely represented a half of the total in the region comprising the waterfronts of Monterey and New Monterey. (Later in the afternoon Mr. Sette counted 2600 from the same position, thus virtually corroborating the previous estimate.)

According to Doctor W. K. Fisher the species dominantly represented were the glaucus-winged, the western, and the herring gulls, in the order named.

There can not be much doubt as to the fact that the birds in Monterey Bay were the majority of those within many miles, and many more than are usually present, so that from the rough figures given some estimate of the maximum amount of fish they might consume can be derived. Taking a pound of sardines a day as all a sea gull would consume, an estimate probably very excessive, and considering them all as fish eaters, the four thousand within sight would be satisfied with two tons. This would be about six-tenths of one per cent of what are taken daily by fishermen at this point. Furthermore it is almost certain that most of the fish eaten by the gulls are the sardines discarded by the boats and canneries, or other species locally abundant. Doctor Fisher calls attention to the fact that gulls are diurnal in habit, and must have trouble in catching live sardines during the light of the day, the more so as they are incapable of diving more than a few inches under the water surface. Naturally, regardless of the exact proportion the gulls in sight were of the grand total, the amount eaten is not one which threatens to deplete the sardine. And as a matter of fact, the presence of so many gulls should be rather a sharp commentary on the waste during the handling of the fish.

These remarkably large flocks of gulls which obtain their food from the sardine industry are supposed to stay at night on some rocky islets at some distance from the canneries, but Mr. Sette who has collected samples of the sardine catch throughout this season, states that he has observed gulls to the number of thirty or more feeding on the sardines lost overboard from lighters unloading about 11:30 at night, hence during total darkness, on January 20 of this year. Whether this is a normal or usual habit with them he does not know. W. F. T.

OCCURRENCE OF A RARE CRAB.

Mr. T. Taniguchi, one of the Japanese fishery experts at one time engaged in the albacore fishery for the Fish and Game Commission, has forwarded three crabs taken from a depth of twenty-five fathoms on a rock cod bank about half way between San Diego and the Coronado Islands. They prove to be very interesting specimens of the same species as one taken by the United States vessel, the "Albatross," during her deep sea work on this coast in 1889 at Station 2946, latitude 33 degrees 58 minutes north and longitude 119 degrees 30 minutes 45 seconds west, and described by James E. Benedict as *Galathea californiensis*. The correspondence between our specimens and the one described by him is very close, and no doubt exists concerning the identification.

The present specimens were taken by the boat "Julia," engaged in rock cod fishing, and were inside a silicious sponge, one of the open Hexactinellid type, about three feet in diameter. They were taken February 5, 1920. The largest is 50 millimeters in length from the telson to the tip of the rostrum. W. F. T.

SCIENTIFIC WORK OF THE "ALBACORE" IN DECEMBER.

Early in December of last year, the "Albacore" made its final trip of the season for the collection of data on the life history of the halibut. During the greater part of last year, trips were made at regular intervals for the purpose of collecting data on the distribution of the eggs and young of food fishes and the location of their spawning grounds, as well as the collecting of data on the life history of the halibut, but owing to insufficient equipment a part of this work was discontinued, and now all of it is temporarily stopped, due, in part, to the centering of the attention of the laboratory staff on other and more pressing problems. The results of the December trip are of special interest because they illustrate both the practical or immediate, and the more purely scientific values of such work.

In hauling for flatfish, a special otter trawl modified from the commercial paranzella or drag net is used, with ordinary manila rope towing warps. This gear is simple and crude, but catches are made averaging from 500 to 1500 pounds of fish and invertebrate animals, including as high as twenty species of fish in one haul. Although the work has been chiefly confined to inshore operations, on December 9 and 10 two hauls, which yielded valuable results, were made in water about 50 fathoms deep on a good trawling bottom off Huntington Beach, Orange County.

Besides taking a commercially successful catch of market fish, red rock cod (*Sebastodes sp.*) halibut, flounders, and sole of various species—these hauls revealed the presence of several species of excellent food fishes not commonly taken in these waters and rare or unknown in the markets. One of these was the sand dab, *Citharichthys sordidus*, so common in the San Francisco markets. These fish are not caught in any quantity in the south, and the southern markets therefore receive their supply from the north.

Another species taken in considerable quantities in the hauls was the yellow-spotted sanddab, *Citharichthys xanthostigma*, recorded for the first time from the California coast in CALIFORNIA FISH AND GAME for April, 1919. This sand dab is a wider, plumper fish, with more meat for the amount of bone than the common dab from San Francisco and would be more valuable if the location of profitable banks were known and a stable supply in the markets insured.

Two species of "sole" were also taken which might be found in commercial quantities in the south if they were sought in deep enough water. These were the slippery or Chinese sole, *Microstomus pacificus*, and the long-finned or rex sole, *Glyptocephalus zachirus*. Both are common in the San Francisco markets where they are often strung with sand dabs in bunches and all sold together under one name, but are unknown in local catches in the south.

Another species taken in these hauls was the sable fish, or Alaska black cod, *Anoplopoma fimbria*. This fish is common north of San Francisco, but is said by naturalists to be rare in southern California and seldom seen in the markets. It is, however, by no means uncommon in the south but is so little appreciated that it is grossly misnamed "hake" by the rock cod fishermen, who take considerable numbers on their lines, but reject it from the catch as worthless because the flesh is rather soft. The United States Bureau of Fisheries has advocated the exploitation of this fish in northern waters, and methods for its use have been devised. It is said to be particularly adapted to salting and drying.

Thus we see that several useful food fish have been added to the list of edible fish taken by the "Albacore" by changing the method of fishing and the locality fished, and it would seem from this that great good could be accomplished by further prospecting and experimenting in deeper water.

Of no less importance than the results recorded above are those of greater scientific interest. Besides supplying data from about 300 halibut concerning their age and rate of growth, their spawning period, and fecundity, several species were taken which extend somewhat the known range of the species, adding to our knowledge of their geographical distribution.

One of the surprising finds was the rare and little known smelt, *Argentina sialis*, Gilbert. This little fish, about three inches long, is our only southern California representative of the family Argentinidae, or true smelts, but is not related to the "smelts" common in the south, which belong to a different family. About 300 specimens were taken and they agree in all essential points with the description of the type specimen, which is the only specimen of this species known. This type specimen was recorded and described by Doctor Gilbert in 1890 as from the Gulf of California, Albatross Station No. 3017, latitude 29 degrees 54 minutes 30 seconds north, and longitude 113 degrees 01 minutes 00 seconds west, in 58 fathoms.* Our specimens were taken December 9 and 10, 1919, in 45 fathoms off Huntington Beach, and this seems to be their second recorded occurrence.

Two specimens of the peculiar little eel-pout, *Lycodopsis pacificus* (Collet), family, Zoarcidae, occurred in one of the above hauls. These were immature specimens and differed somewhat in coloration from current descriptions of the species. This species is recorded as occurring rather commonly in water of moderate depth from San Francisco to Puget Sound, so that this occurrence extends the known range considerably southward.

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*Proceedings U. S. National Museum, 1890, p. 56.

Two other species were taken which are known to occur as far south as Point Concepcion, and although not actually extending their known range appreciably, may nevertheless be listed as rare here at their extreme southern limit. They are the starry skate, *Raja stellulata*, Jordon and Gilbert, and a flounder, *Pleuronichthys decurrens*, Jordon and Gilbert. E. H.

LIFE HISTORY NOTES.

WINTER OCCURRENCE OF THE FULVOUS TREE DUCK IN THE CENTRAL SAN JOAQUIN VALLEY.

In that definite winter records are few in number, it is well to record the occurrence of the fulvous tree duck, *Dendrocygna bicolor*, in the central San Joaquin Valley during the winter of 1919-1920. As late as January 22 of this winter Mr. J. L. Kinnear, of Newman, saw a flock of five of these ducks on the Newman Club grounds; and still later, on January 31, Mr. C. C. Huber, also of Newman, killed two of these ducks on the Newman Club grounds. One of these specimens, mounted, Mr. Huber presented to Mr. Otto Feudner, of the Peters Cartridge Company, 583 Howard street, San Francisco, where it is now on display. The other mounted specimen he still retains in his possession. There were also a few fulvous tree ducks seen and some killed on the Gustine Club grounds during January.—J. E. NEWSOME, *Newman, California*.

THE POMFRET, NEAR FORT BRAGG.

Two specimens of the pomfret, *Brama raii*, were caught about three miles off the coast near Fort Bragg by W. G. Vossbrink, on July 23, 1919. They were taken on a salmon troll with spoon hook, 35 fathoms of line being out at an estimated angle of 30 degrees The fishes measured 16½ inches and were bright silver in color. Authors have described this species as sooty gray, which appears to be characteristic of preserved specimens only, where the brilliant silvery pigment has been destroyed. An example in the National Museum which was taken off the coast of Washington, offers every evidence of having been like these specimens, as bright as a new dollar. A touch of the finger will often efface the metallic color.—J. O. SNYDER, *Palo Alto, California*.

WHERE DO DEER SLEEP.

I have many times observed that mule deer in the Southern Sierras always bed within thick cedars or other forest trees on moonlight nights, whereas the same deer apparently sleep out in the open, as for instance in an apple orchard or among brush, during the dark of the moon. Whether this is a constant habit or one but locally developed I can not say, but it seems reasonable to believe that these various locations are chosen as a means of protection from enemies.—O. P. BROWNLOW, *Porterville, California*.

UNITED STATES FOREST SERVICE COOPERATION.

FIRE AND OUR FORESTS.

We have lately had a sudden, energetic flare of discussion all over California upon the ancient notions of "Piute forestry" whose deep fire-scars remain upon so many of our giant landmark pines and sequoias. It can be made to sound very plausible: "burn off the rubbish, the dead limbs and 'stubs,' the thick undergrowth and chaparral; clear the way for more forest, incidently get more grass, besides, all the tree-beetles which destroy so much standing timber." All this by light surface fires—variously applied, kept as far as possible under control, and aimed at producing a smooth forest floor.

The Forest Service is solidly opposed to every sort of "light burning" because they have seen it in practice many times, and under all sorts of conditions; so are the foresters of all other civilized countries. This does not mean, of course, that foresters do not desire to burn "stubs" and dead trees so dangerously apt to be struck by lightning or burn the "tops" after logging wherever that can be done with safety, in the cool season.

The underlying principles of all scientific forestry, however, are these: Save the young growth as well as the mature trees; protect the soil; encourage reproduction; fill up all possible gaps in the forest cover—do not make more by surface fires—fight all fires to a finish. Furthermore, as the forester knows, the fire-weakened, fire-scarred tree becomes almost certainly the prey of forest insects. The main points in all this are reproduction and soil protection from loss of humus and from washes; these last are so important as to deserve another little talk later.

GAME IN THE CALIFORNIA NATIONAL FOREST.

It is generally conceded that the California National Forest contains a larger number of black-tailed deer than any other locality of equal size, and that the conditions on the forest for propagation and protection are unequalled in the west. Embracing as it does large areas of heavy brush which provide protection from natural enemies and almost unlimited forage during the entire year; large glade areas which remain practically snowless during the winter months, providing an abundance of winter feed when not fed too closely by domestic stock; and large areas of open timber, well stocked with succulent weeds and grasses, it can well be said to be ideal as a locality adapted to the perpetuation of this valuable game species.

The mating season for deer on this forest ranges from late September in the foothills, to November at the higher altitudes. The bucks shed their horns from January 15 to March 15, and new growth is noticed by June 1. The horns become hard about August 1, although at the higher elevations they are still found in the velvet during the latter part of August, and even up to September 10. The fawns appear from June 1 to the end of July, and in most cases are in pairs.

There are a few black and brown bear on the forest, but they can hardly be taken seriously as a game animal. In fact they are used by unscrupulous hunters as an excuse to go into the mountains with packs of hounds during the winter season, when there is no doubt that many violations of the game laws are committed. These bears are often very troublesome to sheep permittees and settlers within the forest who raise hogs, as the older ones frequently develop predatory tendencies. It is probable, also, that they are responsible for many of the kills of deer made by panthers, as they feed on the deer killed by the panther and disturb it in such a way that it is no longer palatable to the panther, who makes a new kill.

The most important game bird on the forest is the mountain quail. It is found in all parts of the forest above the brush line which surrounds the forest on three sides, and during the past two years have shown a gratifying increase. This is attributed in part to the destruction of ground squirrels and other small egg eating animals by the United States Biological Survey.

Valley quail are common at the lower elevations, and they, also are on the increase.

The principal fur-bearing animals on this forest, and the numbers caught during the present season so far as shown by the incomplete records at hand, are as follows:

Skunk	459
Fox (gray)	337
Coyote	241
Wild cat	136
Ring-tailed cat	119
Coon	74
Civit cat	25
Fisher	23
Badger	20
Panther	6
Bear	5
River otter	4

During the past two or three seasons there has been a large increase in the number of trappers. It is estimated that there are fifty trappers on the forest during the past season.

REPORTS.

CALIFORNIA FRESH FISHERY PRODUCTS, OCTOBER, NOVEMBER AND DECEMBER, 1919—Continued.

Compiled by Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexico
Albacore										81		674,826		304		675,211	64,210
Anchovy								23,336		283,210		188,910				495,456	
Barracuda	150							26	28,863	43,425	45,421	129,368	242	104,949		352,444	1,201,366
Bluefish									2,009	12,818						14,827	
Bocaccio								14,799	61,832	181,877						258,508	
Bonito									1,169	2,284	4,969	1,092,999	187	151,203		1,252,811	498,868
Carp				9,933	34,612		4,920	33					1,875	624		52,027	
Catfish		5,587		2,080	4,122		2,771									14,560	
Chilipepper								2,271	6,808	3,149						12,228	
Coalfish								110,384	4,164	5,907						120,455	
Cultus cod	1,477							193,268	24,062	82,821						301,628	
Dogfish			47				46	41,899	544	875		15,652		78,853		137,916	
Dolphin																	
Eels																	
Flounder	353		34	118			38	69,511	1,437	2,677	100	2,817	175			77,290	
Greenfish																	
Hake								45,375								45,375	
Halibut	1,985							9,832	407	889	61,050	224,446	418	90,154		389,181	1,160,200
Hardhead					17,523		211									17,734	
Herring	577		9,160				1,420	4,072	400					100		15,729	
Kingfish			12					1,477	2,055	11,177	300	137,572		1,129		156,722	559
Mackerel			11						2,283	127,190	5,375	651,639	1,944	31,439		819,884	39,226
Marlin																	
Mullet													485	217	4,069	4,801	1,650
Perch	2,648		7,443				155	11,948	14	5,768		43,341		60		71,377	
Pike				30	678		401									1,109	
Pompano								3,928		620		6,300		175		11,023	
Rock bass											1,855	50,954	301	9,895		63,005	649
Rock fish	1,223							202,562	84,396	144,694	7,205	305,440	1,373	120,465		867,358	1,671
Salmon	934,154	941	1,435	29,851	10,838		161,275	159		67						1,138,720	

Sanddab	----	----	----	----	----	----	----	74,762	12,006	373	----	1,722	----	----	----	88,858	----
Sardine	----	----	----	----	----	----	----	1,338,693	2,618,900	31,219,905	----	2,894,703	----	734,489	----	38,806,090	----
Sculpin	----	----	----	----	----	----	----	----	----	----	----	6,929	571	----	----	7,500	----
Sea bass (black)	----	----	----	----	----	----	----	----	----	----	333	33,166	----	15,915	----	49,414	44,361
Sea bass (white)	----	----	14,584	----	----	----	----	17,369	23,228	6,498	3,589	230,952	21	7,184	----	303,425	31,852
Sea trout	----	----	----	----	----	----	----	----	----	----	----	1,319	----	15	----	1,334	335
Shad	----	----	----	3,147	173	----	6,388	45	----	----	----	----	----	----	----	9,753	----
Shad (buck)	----	----	----	----	----	----	45	----	----	----	----	----	----	----	----	45	----
Shad (roe)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Sheepshead	----	----	----	----	----	----	----	----	----	----	----	1,412	----	1,036	----	2,448	----
Skate	----	----	----	----	----	----	----	22,875	506	----	----	629	4	----	----	24,008	----
Skipjack	----	----	----	----	----	----	----	----	1,523	541	----	253,975	----	350,523	----	606,562	1,450
Smelt	19,090	----	10,587	----	----	----	4,456	8,854	15,737	24,177	5,190	68,302	94,764	19,652	----	270,869	3,735
Sole	242	----	----	----	----	----	----	1,458,365	25,280	1,536	4,509	13,674	----	1,465	----	1,505,091	----
Split tail	----	----	----	----	108	----	450	----	----	----	----	----	----	----	----	558	----
Striped bass	----	----	----	38,594	6,834	----	47,821	4,788	----	75	----	----	----	----	----	98,112	----
Stingaree	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Suckers	----	----	----	----	2,154	----	----	----	----	----	----	----	----	----	----	2,154	----
Surf fish	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Swordfish	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Tomcod	----	----	----	----	----	----	----	5,756	----	----	----	----	----	----	----	5,756	----
Trout (farm)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Trout (steelhead)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Tuna	----	----	----	----	----	----	----	----	25	24	----	20,326	----	45,746	----	66,121	53,734
Tuna (blue fin)	----	----	----	----	----	----	----	----	----	----	----	937	----	----	----	937	----
Tuna (yellow fin)	----	----	----	----	----	----	----	----	----	----	----	2,161	----	----	----	2,161	----
Turbot	----	----	532	----	----	----	----	----	----	----	----	----	----	----	----	532	----
Whitebait	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
White fish	----	----	----	----	----	----	----	----	----	----	1,305	6,924	----	3,547	----	11,776	70
Yellowtail	----	----	----	----	----	----	----	----	----	----	----	1,521,433	410	375,381	----	1,897,224	110,736
Miscellaneous	----	----	4	106	----	----	10	4,504	3,257	3,668	12,010	100,575	271	4,806	----	129,211	345
Total fish	361,899	6,528	43,852	83,859	77,672	----	230,407	3,670,292	2,920,893	32,169,346	153,211	8,683,433	103,041	2,149,356	4,069	51,257,258	3,214,970
Crustaceans—																	
Crab (doz.)	296	----	----	----	----	----	----	21,185	1	15	3	----	----	----	----	21,500	----
Ecrevisse (doz.)	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Shrimp	----	----	----	----	----	----	----	81,851	----	----	----	107	----	----	----	81,958	----
Spiny lobster	----	----	----	----	----	----	----	----	----	----	14,372	123,894	25,940	32,431	----	196,637	269,434

CALIFORNIA FRESH FISHERY PRODUCTS, OCTOBER, NOVEMBER AND DECEMBER, 1919—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexico
Mollusks—										155,517	19,848					175,620	
Abalones		225									460	2,908	498	18		6,428	65,905
Clam (cockle)	786		1,758														
Clam (mixed)	7,030	120	5,249													12,399	
Clam (Pismo)											59,997					59,997	
Clam (soft shell)	210	1,124	1,850				60,652	425								64,261	
Cuttle fish								1,033	81	2,639		100				3,853	
Mussels			209				1,248	390			489	1,126	163			4,225	
Oysters (shell)																	
Eastern, No.			248,737					1,389,050								1,637,787	
Oysters (native)			17,615													17,615	
Snails																	
Squid										9,001		586				9,587	
Miscellaneous—																	
Frogs																	
Terrapin																	
Turtle																	171,000

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE YEAR 1919.

Compiled by Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Glenn, Colusa	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
Albacore										81		11,225,857	126	2,326,961		13,553,025	77,874
Anchovy			261,000					11,896		765,645		576,837		21,770		1,639,548	
Barracuda	150							814	31,321	67,512	137,752	2,533,258	51,796	1,216,249		4,038,852	1,786,105
Bluefish									9,750	55,046						64,796	
Bocaccio		80						61,863	104,630	1,153,078						1,319,651	
Bonito									1,169	2,306	23,714	2,534,433	1,042	341,024		2,903,688	600,353
Carp		7,115		14,154	165,722	80	57,342	14,426				50	1,875	624		261,388	
Catfish		28,625		17,323	71,878		36,322	708								164,856	
Chilipepper								207,159	7,145	17,524						231,828	
Coalfish								319,666	6,926	8,208	18	132				334,950	
Cultus cod	8,468	59,945						773,712	67,236	151,753		2,022				1,063,136	
Dogfish			255	11			885	143,564	1,239	5,177	3,005	62,416		395,631		612,183	
Dolphin																	
Eels								10								10	
Flounder	11,498		1,218	1,153			2,540	358,613	27,701	1,184	3,621	14,610	490			425,731	
Greenfish												2,405				2,405	
Hake								122,913	9,320	948						133,181	755
Halibut	19,844	106,717	808					37,784	4,576	18,584	316,861	1,465,499	60,832	492,387		2,523,895	2,335,603
Hardhead					47,634		1,627									49,291	
Herring	7,146		3,740,518				62,712	478,673	750					100		4,289,899	
Kingfish			44					11,481	35,260	71,355	1,492	149,598	104	9,127		698,561	614
Mackerel	180		11						3,518	450,717	20,294	2,037,581	15,544	126,748		2,654,596	48,086
Marlin																	
Mullet												270	485	356	6,428	7,539	1,660
Perch	27,057		55,901				273	22,495	16,491	9,933		19,839	221	9,101		191,341	1,140
Pike				519	2,840	10	3,141									6,510	
Pompano			2					4,015	1,113	867		54,924	32	471		61,424	
Rock bass											2,484	190,315	5,962	243,794		442,555	7,674
Rock fish	13,503	1,492						1,127,029	305,439	459,426	85,447	1,148,074	4,885	568,890		3,714,185	67,649
Salmon	1,458,162	2,899,603	15,571	1,732,028	314,202	220,309	2,262,509	1,427,137	499,168	2,316,854		10				13,145,553	

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE YEAR 1919—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Glenn, Colusa	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
Sanddab								628,206	5,141,869	81,447,280	54	51,600,191	25	11,183,539		153,877,179	
Sardine			141,700					1,362,518	67,885	2,602	1,394	7,830		1,821		709,738	
Sculpin												24,217	1,111	104		25,432	
Sea bass (black)											3,183	67,464	1,825	54,525		126,997	58,273
Sea bass (white)	121		27,904					23,045	317,432	18,934	29,563	1,836,454	2,631	103,650		2,359,737	74,277
Sea trout	47											15,385	15	5,576		21,023	377
Shad				56,363	89,127		26,866	9,251				25				181,632	
Shad (buck)				144,430	14,050		289,821									448,301	
Shad (roe)				176,821	16,752		750,232									943,805	
Sheepshead												7,331	842	9,796		17,972	
Skate								241,811	1,498		543	8,535	479			252,776	
Skipjack									3,173	1,884		4,089,287		2,791,025		6,885,369	12,115
Smelt	46,933		69,666				4,701	138,095	51,611	109,759	9,597	145,693	128,262	47,523		751,870	5,110
Sole	1,178	15						4,914,533	398,245	49,543	71,451	87,899		5,821		5,528,685	
Split tail					12,862		11,420									24,282	
Striped bass			1,581	206,828	72,775		371,866	108,264		1,031						762,345	
Stingaree			38,200					4,000						821		43,021	
Suckers					5,790		43									5,833	
Surf fish																	
Sword fish												17,900		352		18,252	
Tom cod								31,310								31,310	
Trout (farm)																	
Trout (steelhead)	17,217															17,217	
Tuna									25	21	17	1,993,486	854	200,178		2,194,584	266,727
Tuna (blue fin)												14,952,462		38,398		14,990,860	
Tuna (yellow fin)												348,023		58		348,081	
Turbot			1,652					463								2,115	
Whitebait			403					5,512								5,915	
White fish											1,305	18,034		7,852		27,191	70
Yellowtail											191	2,531,973	4,506	2,335,093		4,871,763	133,502
Miscellaneous	356		4	106	599		31	45,320	6,012	8,342	54,450	423,219	2,997	13,413		554,879	15,907
Total fish	1,611,863	3,113,592	4,359,541	2,350,936	814,261	220,399	3,882,331	12,766,286	7,120,315	87,137,997	766,439	103,523,604	286,941	22,553,181	6,428	250,453,244	5,493,871

Crustaceans—																	
Crab (doz.)	1,882							51,935	428	128	3					54,376	
Ecrevisse (doz.)																	
Shrimp								747,023				107				747,130	
Spiny lobster											19,465	167,680	29,852	39,897		256,894	832,571
Mollusks—																	
Abalones	450	225							740	248,056	509,732					759,203	65,905
Clam (cockle)	786		15,857								1,020	5,768	1,328	18		24,777	
Clam (mixed)	27,699	1,688	34,605					251			2,228	273				66,744	
Clam (Pismo)									175		417,340					417,515	
Clam (soft shell)	210	8,728	27,945				265,268	425								302,576	
Cuttle fish			36					6,294	1,378	9,663	137	3,984				21,492	
Limpets													8,350			8,350	
Mussels	830		209				4,947	1,155	940	925	11.677	5,424	8,888	100		35,095	
Oysters (shell)																	
Eastern, No.			1,342,828					5,545,468								6,888,296	
Oysters (native)			91,950													91,950	
Snails												653				653	
Squid									92	3,689,299		8,406		445		3,698,242	
Miscellaneous—																	
Frogs (doz.)								328								328	
Terrapin (doz.)	2	64						84			10					160	
Turtle																	255,239

CANNED, CURED AND MANUFACTURED FISHERY PRODUCTS OF CALIFORNIA FOR THE YEAR 1919.

Compiled by the Department of Commercial Fisheries.

CANNED.

Species of fish	Size of cans	San Diego district, cases	San Pedro district, cases	Monterey Bay district, cases	Northern California district, cases	Total cases
Abalone	1-lb.		105		2,873	2,978
Albacore	1-lb.	5,862	21,236			27,098
	½-lb.	37.855	107,822			145,677
	¼-lb.	4,152	15,325			19,477
Anchovy	¼-lb.	184	32			216
Barracuda	1-lb.		8			8
Bonita	1-lb.	12	2,177			2,189
	½-lb.	4.965	34.634			39.599
	¼-lb.	287	17,108			17,395
Caviar	¼-lb.		395			395
	3-oz.		374			374
Herring	1-lb. oval				28,236	28.236
	½-lb. oval				1,589	1,589
Mackerel	1-lb.	66	1,995			2,061
	½-lb.	17	6 344			6,361
	¼-lb.		988			988
Rock bass	¼-lb.		10			10
Salmon	1-lb. oval			102	725	827
	1-lb. tall				1,941	1,941
	1-lb. flat				9,086	9,083
	½-lb. flat				18.667	18.667
Sardines	1-lb. oval	33,594	113,909	790,724	7,842	946,069
	1-lb. round		11,875			11,875
	1-lb. tall				7,318	7,318
	½-lb. oval	3,878	27,713	11,960		43,551
	½-lb. square	9,543	17,510	7,207		34,260
	½-lb. round	405	25,742	128		26 275
	¼-lb. round	10	3.213			3.223
	¼-lb. square	39,603	31,553	7,789		78,945
Shad	1-lb.				4,350	4,350
Shad roe	½-lb. oval				1,131	1,131
Skipjack (striped tuna)	1-lb.	3.199	750			3 869
	½-lb.	38,229	28,849			67,078
	¼-lb.	2.460	11,351			13,811
Squid	½-lb.			3,538		3,538
Tuna	4-lb.		1,905			1,905
	1-lb.	1,170	33,524			34,694
	½-lb.	14,555	291,453			306.008
	¼-lb.	2,785	119,980			122,765
Turtle		7,407				7,407
Yellowtail	1-lb.	12	350			362
	½-lb.	19,291	8,739			28,030
	¼-lb.	5				5
Total cases canned		229,466	936,969	821,448	83,758	2,071,641

DRIED, SALTED, SMOKED AND MISCELLANEOUS.

Species of fish, size or quantity	San Diego district	San Pedro district	Monterey district	Northern California district	Total
Albacore bellies, smoked, lbs.		4.368			4.368
Anchovy, salted, lbs.		63,150	242,576	24,448	330,174
Anchovy, salted, 5-lb. cans, 24 cans to case			243		243
Anchovy, salted, 5-lb. cans, 12 cans to case			367		367
Anchovy, salted, 24-lb. cans, 6 cans to case			119		119
Anchovy, salted, 12-lb. cans, 8 cans to case			216		216
Anchovy, salted, 1½-lb. cans, 24 cans to case			200		200
Anchovy, salted, 2½-lb. cans, 12 cans to case		1,800			1.800
Barracuda, dried, lbs.	67,102				67.102
Barracuda, smoked, lbs.		2,000			2.000
Bonito, salted, lbs.		68 760			68,760
Bonito, smoked, lbs.		31 003			31 003
Cuttle fish, pickled, lbs.		3,800			3.800
Herring, smoked, lbs.				1.000	1,000
Herring, sugar cured, lbs.				1,450	1,450
Mackerel, salted, lbs.		24.842			24.842
Miscellaneous fish, dried, lbs.	51,037	46.479	15,000		112,516
Miscellaneous fish, salted, lbs.	20,000	59,079			79,079
Rollmops, 10-lb. pails				1,142	1.142
Sablefish, salted, lbs.				7,519	7,519
Sablefish, smoked, lbs.				5,400	5,400
Salachini, 100-lb. tubs			100		100
Salachini, 65-lb. tubs		740	14,370	1,362	16,472
Salachini, 45-lb. tubs			987	358	1,345
Salachini, 30-lb. tubs			4,020		4,020
Salmon, mild cured, casks*			1,044	4,153	5,197
Salmon, hard salted, casks*				30	30
Sardines, dried, lbs.			15,000		15,000
Sardines, salted, lbs.		43,982	260,500		304.482
Sardines, smoked, lbs.				2,200	2.200
Sardines, salted, 2½-lb. cans, 12 cans to case		4,000			4.000
Sardines, salted, 3-lb. cans, 24 cans to case		6,007	200		6,207
Sardines, salted, 5-lb. cans, 24 cans to case			573		573
Sardines, salted, 12-lb. cans, 8 cans to case			739		739
Sardines, salted, 24-lb. cans, 4 cans to case			450		450
Sardines, salted, 34-lb. kegs			1,600		1,600
Sea bass (black), dried, lbs.	26,830				26.830
Skipjack, smoked, lbs.		2,601			2.601
Squid, dried, lbs.			686,159		686.159
Tuna, smoked, lbs.		10,180			10.180
Yellowtail, smoked, lbs.		45,933			45,933
Fish meal, tons	1,674	5.637	3,331	481	11,153
Fish, oil, gallons	26,791	146,298	300,833	40,340	514,262
Number of plants	15	35	28	21	99
Number of employees	1,191	3,928	2.218	905	8.242
Estimated value of pack	$2,599,852	$9,694,482	$6,990.566	$2,132.843	$21,417,743
Value of plants	1,100,700	4,335,657	1,366,189	906,325	7,708,871

*Casks contain 800 pounds net.

VIOLATIONS OF FISH AND GAME LAWS.

October 1 to December 31, 1919.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	62	$930 00
Refusing to show license on demand	1	25 00
Making false affidavit on shipment of deer hides	1	25 00
Shipping deer meat without affidavit	3	50 00
Deer—excess limit—close season—killing or possession	22	675 00
Female deer—spike bucks—fawns—killing or possession	7	350 00
Illegal deer hides	1	------------
Hunting on posted grounds	1	25 00
Night shooting	30	745 00
Trapping without license—close season	4	20 00
Killing a mountain sheep	1	30 00
Protected shore birds—killing or possession	56	1,305 00
Nongame birds—killing or possession	47	916 00
Shooting ducks from power boat in motion	10	150 00
Ducks—excess limit—close season	15	425 00
Quail—close season—killing or possession	36	960 00
Pigeons—close season—killing or possession	3	85 00
Doves—close season—killing or possession	1	25 00
Grouse—close season—killing or possession	1	25 00
Mudhens—close season—killing or possession	1	25 00
Cottontail and brush rabbits—close season	9	110 00
Total game violations	312	$6,901 00
Fish.		
Angling without license	3	$30 00
Fishing for profit without license	4	110 00
Striped bass—underweight—close season	5	120 00
Halibut—underweight—offering for sale—close season	4	75 00
Salmon—excess daily limit	1	------------
Taking salmon with snag hooks	2	100 00
Operating salmon net in closed district	3	200 00
Trout—excess daily limit—close season	5	50 00
Catfish—undersize—offering for sale	1	20 00
Failure to maintain fish screen	1	20 00
Clams—undersized—excess limit	4	110 00
Female crabs—taking or possession	1	20 00
Abalones—red and black—under and oversized—taking or possession	12	270 00
Lobsters—under and oversized—close season—taking or possession	12	280 00
Total fish violations	58	$1,405 00
Grand total fish and game violations	370	$8,306 00

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS.

October 1, 1919, to December 31, 1919.

Game.

	Pounds
Deer meat	1,074
Quail	114
Ducks	1,067
Doves	18
Pigeons	2
Rabbits	17
Avocets	4
Kildeer plover	28
Swans	5
Sandpipers	18
Miscellaneous birds	103
Deer hides	6

Searches.

Illegal fish and game	8

Fish.

	Pounds
Striped bass	6,000
Salmon	852½
Halibut	6,621½
Trout	78
Catfish	5
Sturgeon	39
Barracuda	3,995
Miscellaneous fish	33
Clams (cockle)	916
Clams (Pismo)	456
Crabs	1,627
Lobsters	4,752
Abalones	93
Illegal nets	3

STATEMENT OF EXPENDITURES YEAR 1919.

	September	October	November	December
General administration	$3,170 98	$2.551 00	$2.384 00	$2.103 63
Research, publication and education	931 38	312 58	296 24	419 05
Printing	316 13	1,630 34	111 77	178 25
Fish exhibits	483 78	6,110 55	3 25	
Game exhibits				
Tahoe camping ground	37 23	8 00		
Mountain lion bounties	320 00	520 00	390 00	370 00
Lithographing hunting licenses			300 00	
Lithographing angling licenses		315 00		1.090 00
Hunting license commissions	2,400 50	3,626 80	1,544 60	2,673 90
Angling license commissions	1,322 90	1,471 90	1,242 90	2.186 60
Market fishing license commissions	131 50			149 50
San Francisco District	8,161 99	7,752 01	7,045 73	6,684 94
Sacramento District	5,830 40	5,654 19	5,322 42	5,008 57
Los Angeles District	2,996 46	3,079 82	3,004 65	2,921 47
Launch patrol	5,993 55	1,753 47	2,280 91	1,141 75
Prosecutions (fish and game)	155 89	304 75	276 50	63 00
Crawfish inspection	100 00	100 00	100 00	100 00
Winter game feeding				
Accident and death claims	143 59	278 42	202 65	124 04
Hatchery administration	1,296 55	1,450 51	1,289 72	1,324 73
Mount Shasta Hatchery	2,977 87	1,696 39	2,965 24	2,135 71
Klamath Station	1,369 58	1,151 14	949 72	458 82
Fall Creek Hatchery	422 91	395 49	818 98	939 00
Mount Whitney Hatchery	2,077 83	1,878 63	2,577 64	1,139 97
Cottonwood Creek Station			236 50	
Cottonwood Lakes Station				
Tahoe Hatchery	164 98	334 10	156 11	40 15
Tallac Hatchery	587 66	5 00	8 00	5 00
Chico Experimental Station	63 75		29 00	
Fort Seward Hatchery	1,021 10	1,719 25	910 49	789 23
Eel River Station			96 25	
Ukiah Hatchery		92 00		
Snow Mountain Station	8 50	49 25	11 18	989 17
Brookdale Hatchery	151 33	147 35	156 02	257 74
Scott Creek Station	30 00	31 00	30 00	31 00
Feather River Hatchery				
Almanor Hatchery	7 00	5 00	5 00	5 00
Domingo Springs Hatchery	321 20	57 25	84 43	8 30
Clear Creek Hatchery	203 71	249 06	216 22	
Bear Lake Hatchery	1,119 38	1,432 54	1,229 62	410 50
North Creek Station	403 56	474 78	1,559 45	772 36
Wawona Hatchery			312 87	133 76
Yosemite Hatchery	250 25	219 01	328 29	44 25
Kaweah Hatchery	150 70	92 00	17 00	16 60
Fish transplanting and distribution	1,537 87	4,332 49	1,804 39	319 95
Screens, fishways and water pollution	619 79	698 84	583 86	603 38
Special field investigation		150 35	102 00	
Department of Commercial Fisheries	4,095 52	3,860 81	3,775 18	3.255 76
Totals	$51,409 66	$56,021 07	$44,848 78	$38,898 08

STATEMENT OF EXPENDITURES.

July 1, 1919, to December 31, 1919.

Administration:		
Commissioners	$1,220 59	
Executive officers	14,015 36	
Printing	2,270 70	
Research and publicity	2,591 03	
Accident and death claims	1,159 88	
Total administration		$21,257 56
Commercial fish culture and conservation:		
Superintendence	$6,333 89	
Inspection and patrol	15,400 37	
Research	9,298 34	
Statistics	4,885 79	
Market fishing license commissions	374 00	
Propagation and distribution of salmon	14,464 25	
Total commercial fish culture and conservation		50,756 64
Sporting fish culture and conservation:		
Superintendence	$7,543 07	
Printing	1,596 79	
Prosecutions and allowances	72 00	
Angling license commissions	8,329 20	
Special field investigations	252 35	
Fish exhibits	7,167 16	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	17,757 55	
Sacramento District (40 per cent)	14,990 67	
Los Angeles District (40 per cent)	7,030 02	
Propagation and distribution of sporting fish	73,538 47	
Total sporting fish culture and conservation		138,277 28
Game conservation:		
Printing	$2,396 07	
Prosecutions and allowances	863 14	
Hunting license commissions	12,397 80	
Mountain lion hunting	2,837 13	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	26,636 35	
Sacramento District (60 per cent)	22,486 01	
Los Angeles District (60 per cent)	10,545 04	
Total game conservation		78,161 54
Tahoe camping ground		2,599 11
Total expenditures		$291,052 13

Further information regarding details of expenditures will be gladly furnished upon application to the executive office of the Fish and Game Commission, San Francisco, California.

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 6 SACRAMENTO, JULY, 1920 Number 3

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KING SALMON MARKING EXPERIMENT AT KLAMATH RIVER, 1919.

By W. L. Scofield.

Source of Eggs.

The Chinook or king salmon used in this experiment were from eggs taken by Mr. Hurby of the United States Bureau of Fisheries at the substation on Mill Creek, Tehama County, California, near the town of Tehama about twelve miles south of Red Bluff. Mill Creek is a tributary of the Sacramento River. The eggs were taken about the latter part of November, 1918.

Shipping.

The eyed eggs were shipped in one shipment of 1,153,000 eggs. Though originally billed to the Mount Shasta Hatchery, they were not unloaded but shipped immediately to the new Fall Creek Hatchery on Fall Creek near Copco, Siskiyou County, about sixteen miles from

Hornbrook. The eggs were received at the Fall Creek Hatchery February 13, 1919.

Hatching.

The eggs were hatched at Fall Creek Hatchery from the middle to the end of February, 1919. About July 1, 1919, 25,000 of these small king salmon were placed in the cement-sided pond at Fall Creek Hatchery and the others were liberated in Fall Creek, which is a tributary of the Klamath River, entering just below the California-Oregon Power Company dam at Copco. The hatchery is about a mile up Fall Creek from its mouth.

Mark Used.

The *adipose* and *right ventral* fins were removed by clipping off close to the body with a pair of manicurists' cuticle nippers. The marking, begun November 3 and completed November 15, 1919, was done by L. Phillips of the Department of Fish Culture and W. L. Scofield of the Department of Commercial Fisheries of the Fish and Game Commission of California.

Variation in Size.

Although from the same brood, hatchery practice and rearing pond, there was great variation in the size of the yearlings at the time of marking, the extremes in length being from 1$\frac{3}{16}$ to 5 inches, measured from the tip of the snout to the tip of the central rays of the caudal fin. The small fish, roughly those under two inches in length, were not marked but sorted out as the marking proceeded. These small fish were liberated every day or two.

Counting and Separation.

As 250,000 fish had been counted into the rearing pond, no count was made of unmarked fish while marking. The marked fish were carefully counted each day. Mr. Phillips kept tally of his work while marking. Mr. Scofield counted his work at the end of the half day. In each case at the end of the day the fish marked by each person were placed in a separate trough.

Liberations.

The first fish marked were held to the end of the fifth day in the trough to determine the effect of rough handling. As no injury showed in the fish, the first five days marking was liberated at the end of the fifth day and from then on the marked fish were liberated each day or two. All liberations were made in Fall Creek. November 14 the rearing pond was emptied, thus liberating all the unmarked fish of the 250,000 except a few held in the hatchery troughs. The following day all remaining unmarked fish were liberated.

Control.

In order to determine the possible percentage of fin regeneration, a sample of each half day's marking was retained as a control to be held in the hatchery trough. The control from each person's marking was held in a separate trough. Control fish were obtained by dipping out a few fish with a net and counting out fifty or so without conscious selection. Great care was used in this respect so that the control would be exactly representative of the size classes of marked fish in order that the control might be used for possible future study. The control remained two months in the hatchery troughs from the time of marking until the middle of January, 1920. The control fish were then bottled in formalin and shipped to Professor J. O. Snyder of Stanford University, being received by him January 19, 1920. Through an oversight when bottling the control at the hatchery, the fish marked by Phillips and those marked by Scofield were not kept separate, but since the percentage of regeneration has been found to be almost negligible this attempt to determine the regeneration percentage for each person's marking was scarcely necessary. Roughly, 100 of the control marked by Scofield were shipped to Professor Snyder for his study very soon after the marking and received by him December 1, 1919. Of the 25,850 fish marked 850, or roughly 3 per cent of the total were retained as control, thus leaving an even 25,000 marked fish to be liberated.

Percentage of Fin Regeneration.

To determine the percentage of fins which might be expected to regenerate, the control was examined by W. L. Scofield in February, 1920, with the help of Professor Snyder and Mr. Willis Rich of the United States Bureau of Fisheries. Of the 573 specimens examined but 8 or 1.4 per cent showed signs of possible regeneration and in several of these cases the resulting ventral fin would probably be so deformed as to be recognizable as a mark when found with a missing adipose fin. In no case had the adipose fin shown any sign of regenerating.

Injury from Marking.

But one death was noted among the marked fish soon after marking and none among the control from November 3 to 15, 1919. A report in December from the hatchery stated that the control was apparently perfectly normal and healthy with very few deaths. A few fish were stunned by the rough handling while being marked but when returned to the water would swim off after about one minute and show no further signs of discomfort.

Summary.

Of 1,153,000 king salmon eggs taken in November, 1918, from Mill Creek of the Sacramento, and hatched at Fall Creek Hatchery on the Klamath River in February, 1919, 903,000 were liberated in the Klamath about July 1, 1919, and 250,000 were held in a rearing pond. In November, 1919, the 250,000 from the rearing pond were liberated in the Klamath River after 25,000 of them had been marked by removing *adipose* and *right ventral* fins.

King Salmon Marked at Fall Creek Hatchery.

Date	Number of fish marked	
	By Scofield	By Phillips
1919—November 3	243	1,172
November 4	713	
November 5	595	1,046
November 6	760	1,106
November 7	1,050	1,425
November 8	800	750
November 9	925	1,250
November 10	1,100	1,000
November 11	1,100	1,200
November 12	1,350	1,800
November 13	1,550	1,650
November 14	1,110	1,500
November 15	330	325
Totals	11,626	14,224
Total marked		25,850

Control Counted Out from the Total.

Date	From Scofield marking	From Phillips marking
1919—November 6	50	50
November 9	50	50
November 10	100	100
November 12	125	125
November 13	50	50
November 14	25	25
November 15	25	25
Totals	425	425
Total control		850

Number of Marked Fish Liberated in Fall Creek in November, 1919.

Date	Number
1919—November 7	5,535
November 8	1,425
November 9	4,675
November 10	1,900
November 12	5,200
November 13	3,100
November 14	2,560
November 15	605
Total	25,000

GAME IN THE SAN JOAQUIN VALLEY IN 1853.*

A Little Journal of Incidents Whilst on a Surveying Party with von Schmidt, Deputy Surveyor under Colonel Jack Hays, in the Fall of 1853, on the Tulare Plains.

By Colonel Andrew J. Grayson.

Meeting my friend von Schmidt, a German by birth but raised in the United States, and at that time deputy surveyor, one day as I was walking down one of the streets of San Francisco, and whom I hadn't seen for a long time, I shook him cordially by the hand, when he told me he was just making preparations for a long trip to the Tulare plains and lakes to survey the Standard lines (government survey), and as I had never been in this portion of California, and having heard oft of the great quantities of game in this region of the country interesting to the

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*Between the years 1846 and 1869 there lived in California a naturalist and artist of so great attainment that he became known as the "Audubon of the Pacific." This naturalist was Colonel A. J. Grayson. Born in Louisiana, on the banks of the picturesque Ouachita River, hemmed in by pine forests and cane brakes, Grayson spent most of his boyhood days rambling in the woods or along the banks of the river. While still a child he manifested great talent in the drawing and painting of birds and the wild life scenes with which he was so intimately acquainted; but this was most vehemently discouraged by his parents and he was sent away to school to learn to be more practical. After finishing college young Grayson made an attempt at business, but he had no love for the drudgery of mercantile pursuits. He found no pleasure but in the study of nature, so he gave it up and determined to go to California where his longing for new objects of study in nature's unexplored recesses might be satisfied.

And so it was that about the middle of April, 1846, he found himself at the head of a caravan composed of many well known pioneers setting out on the long overland journey to the Pacific. But as they traveled westward some branched off adventurer, from the fact of its never having been but little explored save by the few wild Indians that live about the lakes, I at once proposed acompanying him on this interesting trip. Von Schmidt was glad to have me go, so I made up my mind to do so, for I hadn't had a hunt for a long time.

So on the evening of the sixteenth of September, 1853, we took the good little steamer ''Sophia'' from San Francisco bound for Stockton. At Stockton we secured wagon, mules and camping equipment and on September 18 our party started on their journey.

At noon of the second day out we reached the Stanislaus River—at Heath and Emery's ferry—where we had our lunch, forded the river and took the Mariposa road. The day was intensely warm and the road heavy and dusty, as it wound through the low hills, sparsely covered with oak and brush. After a few miles we saw a large track of a grizzly which seemed to have just crossed the road. After tracking him through the woods for a while I came to the conclusion that the old Growler had made tracks to the river to quench his thirst and cool his hide, for the day was melting hot and the hills around parched. I couldn't conceive what brought him so far from water at that time of day—and such a day!

We made an uneventful camp that night and by sunrise the next day (September 20) were on our way. We crossed the Tuolumne River at Dickinson's ferry and camped on a creek that night. On September 21 we reached the Merced River at ''Snelings,'' where we camped and caught our first fish and killed our first game—a few quail. The fish were full of fine bones—the same kind I have seen in all the fresh water streams in California—and a very poor fish to eat.

Leaving the river about six miles farther up, we proceeded toward the foothills. As yet we had seen no game larger than quail, but as we advanced towards the wilds the country became more interesting. On September 26 we reached old Stearns' cabin, where we camped. Here I shot quail and doves and one of the boys killed a hare. On the next day we proceeded toward the Chowchilla River, where von Schmidt received instructions from the Surveyor General and commenced his surveying work. Here I went out hunting in the low hills for antelope and came across a herd of them, but they were so wild I could not get near enough to shoot one. Later we camped on the Fresno, then a dry bed, but with a few water holes. Here we saw a large band of wild horses—probably fifty in number—and they went snorting and charging

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in different courses, notably the Donner party; others fell away; and finally Colonel Grayson, with his wife and child and one horse, completed the journey alone.

Almost needless to say, Colonel Grayson, like almost every one else in those early days of California, went to the "diggings" and was so far successful as to be considered one of the wealthy men of San Francisco at one time. His attempts at mercantile pursuits, however, proved failures, as before. The wilds called to him and he determined to renounce business again and adopt the life of a trapper, which would afford him opportunities for the study of ornithology. One of his best known works is his "Birds of the Pacific Slope," which is profusely illustrated with colored drawings, the work of his own hand. So fine were some of these drawings that the State Fair at Sacramento awarded him a special premium "for superior drawings of native birds of California, exhibited at the Fair, 1855."

This noted artist and naturalist, in his various wanderings for the purpose of studying wild life, accepted in 1853 an invitation from a friend to accompany a surveying party to the plains of Tulare County. The accompanying extracts, slightly revised, are from a diary kept by Grayson which refer to the abundance of game prevalent in that region at the time of the trip. The handwritten journal is deposited in the Bancroft Library, of the University of California, and acknowledgement is here made of the courtesy of the Library in allowing its publication.—Editor.

in a circle around us, and then away over the plains. Here also I saw numbers of antelope, but they were too wild to approach.

On September 30 we forded the San Joaquin at Beals' Indian Farm, where we caught salmon and other fish, which appeared in great quantities. Some five or six miles up the river we saw some whooping cranes, a few ducks, heard a mocking bird, and saw antelope. I shot a duck and a hare.

On October 3 and 4 we passed over rolling land, running due north to the Fourth Standard and passing Kings River Slough. On these days we saw great numbers of antelope and wild horses and also a silver grey fox—the first one I had seen this side of the Rockies. At Kings River Slough we killed some bitterns, also saw ducks, black curlews and various other water birds. Fishing also was good. At this slough also we met Indians, and one of them undertook to conduct us on a hunt for elk. With our Indian guide we went westerly toward the Tularies, between Kings River Slough and Kings River. These lands were literally perforated by gophers, moles and other underground inhabitants, and the air was infested with mosquitoes. On this trip we saw great quantities of quail, also the tracks of a grizzly, but found nothing but the *signs* of elk. Our Indian guide, who was on foot, while we rode horseback, became tired out and we returned to camp on the slough.

Von Schmidt continued surveying operations along the Kings, during which time we saw large herds of antelope. Then we proceeded to the main branch of the Kaweah River, to Woodville, the county seat of Tulare County. All branches of the Kaweah abound with fish, and wood ducks were plentiful. Bear signs were everywhere and we killed a cub while in the Kaweah country.

Later, leaving the Kaweah country, we continued to Tula Swamp, where we found signs of elk, but no elk were actually seen. At Tula Slough Creek we found quantities of fish, and I saw for the first time here a roadrunner. Here we killed a few hares, the only game seen.

On October 16 we began our journey over stretches of alkaline desert, under a sweltering sun, and with mirages mocking us in every direction, toward the great Tulare Lake. We reached this lake early in the evening, in time to kill quantities of ducks, snipe, geese and black curlew before dark. We also killed two antelope and a number of hare. We feasted that night after our desert travels. We found all kinds of waterfowl, antelope and hare in abundance around Tulare Lake. And it was here that I killed our first elk. We had gone on a little excursion from the lake (exactly on the line of the Seventh Standard Parallel, about three miles distant), when I saw a herd of four large buck elk. My first shot brought one down, and the others did not seem frightened nor run, and I am sure we could have shot more, but we did not need the meat.

The Indians on Tulare Lake were greatly perturbed over our visit. They feared that we might contemplate squatting on their land. And they were pleased when we told them (through a Spanish interpreter) that we had no such intentions. In fact, the whole country we had traveled over since we left the Four Creeks (Kaweah River) to Tulare Lake is totally unfit for any purpose and can never be settled by anybody but hunters or Indians. And we assured the Indians they need not fear squatters, as no white man would ever want their land.

On October 31 our surveying operations brought us to the main Kern River. Here we found any quantity of elk and waterfowl, and such a place for hunters I never saw! The mallard duck abounded, but of every description of waterfowl my pen could scarcely describe the numbers, or the excitement they would create in the breast of a sportsman. Your ears are confused with the many sounds—the quacking of the mallard, the soft and delicate whistle of the baldpate and teal, the underground-like notes of the rail or marsh hen, the flute-like notes of the wild goose and brant, the wild ranting of the heron, not to forget the bugle-like notes of the whooping crane and swan and a thousand other birds mingling their songs together—creates that indescribable sensation of pleasure that can only be felt by one fond of nature in its wildest and most beautiful form.

We crossed the Kern and went on to Lake Buena Vista. We found the immediate vicinity of this beautiful lake on the side of our approach (from the west) devoid of life, save for the little ground squirrel and the little desert sparrow. Later, however, we found great quantities of white geese and other waterfowl of every description on the southeast shores of Lake Buena Vista. In fact, so great was the number that out of ten shots fired one hundred and eighty-five fowl were killed.

It was here at Lake Buena Vista that von Schmidt completed his surveying operations and we made a quick and uneventful trip to our homes in San Francisco.

NOTES ON DRY-FLY FISHING. No. 4.

By R. L. M., California.

Scene: In the hills in California. Time: Present.

Dramatis personæ:
Clerk of the Hotel.
Angler.
Tourist.

Clerk: Here comes the angler. He can tell you all about that dry-fly stuff they were discussing last night. Angler, let me make you acquainted with Tourist. He wants you to tell him all you know about these dry-flies.

Angler: Well, I'll do my best. (To Tourist.) Are you going fishing today?

Tourist: No, my party is going up to Pine Lake, and as I have had enough riding in a machine to last me a long time, I'm taking a day off and going to loaf round the hotel—unless something better turns up.

Angler: How about coming out with me, then? We shall have the whole day and you can see just how the game is played.

Tourist: I shall be delighted to do so, and I am sure I shall know something about dry-fly fishing when the day is over.

Angler: When can you be ready to start?

Tourist: I am ready now. We have only three rods in the party, and all three are to be used up at the lake. All I need is to get a lunch put up—that won't take me long.

Angler: Well, let's pull out. We have about half an hour's walk before we get to the best part of the river, but a machine will bring us back in the afternoon.

Not fishing yourself, you will have a good chance to really find out something useful about the art. Usually, when anyone comes out with me, they insist on bringing their own rod. The result is, that after about five minutes of instruction, they want to fish themselves; as a consequence they learn very little.

Tourist: I come from Idaho. There we have very good fishing, provided you get well away from the towns.

While we were sitting around the fire last night, this dry-fly talk came up; it mystified me, for I had never heard of it before. Now, just exactly, what is dry-fly fishing?

Angler: I dare say you have noticed that the various insects, such as flies, beetles, or grasshoppers, always float on the surface of the water. Now, the imitations of these insects, known as artificial flies, are made of silk, feathers, fur and other substances. In order to catch the fish, these materials are ballasted with a hook. Now, as long as we can keep our artificial fly dry, it will float on the surface and thus be in much the same position as the natural insect.

Dry-fly fishing simply consists of keeping the fly dry, and if it gets wet, of drying it again as quickly as possible.

Tourist: It sounds simple, but how can it be done? I know that the first time I cast a new fly into the water it floats, but the second or third cast sinks the fly.

Angler: First of all, we put some oil on the fly to keep the water off it. Then, we grease the line, so that the line itself will float. And then, if the fly does get wet, which is not exactly an uncommon experience, instead of returning the fly to the water, on the next cast, we check the fly before it gets there and make a series of false casts backwards and forwards in the air. These false casts drive off any moisture that has collected on the fly and on the line; so that when we do return the fly to the water, it is practically as dry as it was at first.

Tourist: We got in yesterday and had lunch at the hotel. Afterwards, we drove down in this direction and went fishing. I noticed swarms of grasshoppers on the water. The trout were taking them, but they would not look at our flies. We even caught some 'hoppers and tried them, but it was no good; so we packed up and came back to the hotel. Why was it we couldn't catch any fish?

Angler: Well, when you tried flies, you were trying to coax the fish away from a very tempting morsel—viz, the grasshopper—with something that did not attract them at all. And when you used grasshoppers, I dare say, you noticed that your grasshoppers always sank below the surface of the water, whereas an unhooked 'hopper floated on the surface. Then again, the leaders you were using may have been too heavy or thick. These trout are very wise. They are fished for continuously all through the season; it is only natural to suppose that they learn a little by bitter experience. If you could have kept your 'hoppers on top of the water and made them float with the stream in a natural manner you would, in all probability, have gotten some fish.

Tourist: We are getting near where we were yesterday. I recognize that grove of pine trees, but I don't see as many grasshoppers in the air as I did yesterday.

Angler: It is a little early yet. In an hour's time you will see just as many flying as you did yesterday.

Well, here we are at the river.

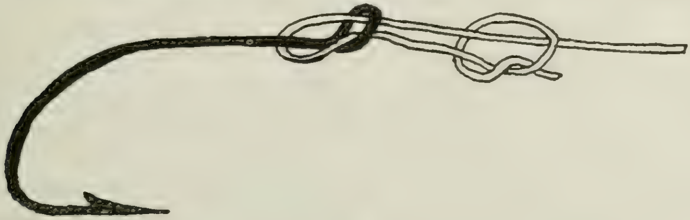

Fig. 29. Proper knot for tying large fly hook to leader.

There surely aren't many 'hoppers floating down yet. But we needn't worry, there will be hundreds later on. In the meantime, I will put my rod together and get ready for the fray.

Tourist: I notice that you have put your reel on with the handle pointing to the left. Are you left handed?

Angler: No, but I hold the rod with my right hand and wind up the line with the left. It is awkward at first, but one soon gets used to it, and I need not point out the advantage of being able to wind up the line without having to change the rod to the left hand, as you will see so many people doing.

Tourist: How long is that leader? Isn't it rather too light to handle a good sized fish?

Angler: The leader is 9 feet long. Although it only has a breaking strain of 2½ pounds, it is quite strong enough for the average big fish hereabouts. I do not expect to get anything much over 5 pounds. Of course, if one got hold of a really big fish, such as 10 or 11 pounds, one would have to be extra careful, but with ordinary luck and management, it is not impossible to land a large trout on a leader such as this.

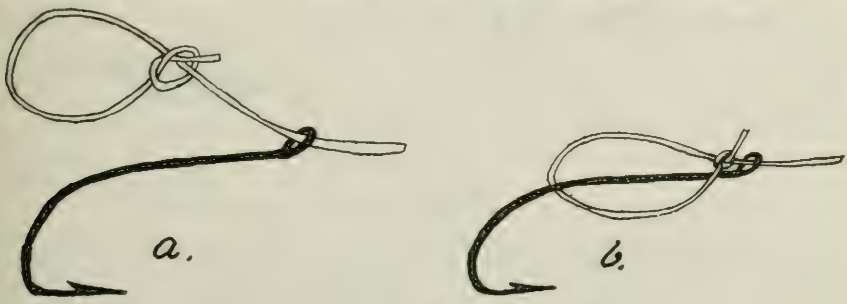

Fig. 30. The "turle" knot, one often used.

Let us sit down here and watch up and down stream for the first sign of a feeding fish.

Tourist: Why not begin fishing now?

Angler: Until you see the fish feeding on top, it is not much good trying to get them with a fly. But in a very short time you will see grasshoppers floating down stream and the fish will begin to feed.

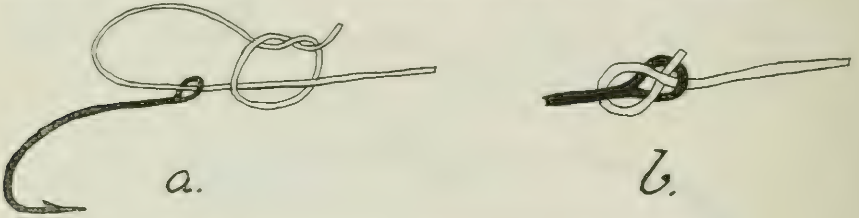

FIG. 31. Jam knots for tying small fly hooks to leader.

Tourist: What kind of a fly are you going to use?

Angler: This one here. I call it "the floating grasshopper fly," and although it does not look very much like a real 'hopper when it is floating on the surface, it has a strong resemblance to a grasshopper in a similar position.

Tourist: How do you tie the fly on to the leader?

Angler: There are several knots that can be used. This first knot is the best for larger flies (fig. 29); then, there is this one (fig 30) known as the "turle" knot, and finally the two jam knots (figs. 31 and 32). These last two are used for small flies.

Now, I will make a cast on that shallow water; you will notice how the fly floats and you must admit that it does look like a grasshopper.

Tourist: Yes, the resemblance is very strong. I see your line is floating as well.

Angler: If you remember, after I had put my rod together and threaded the line through the guides, I pulled off about 40 feet and rubbed the line down with this little pad which is anointed with deer fat. That is what makes the line float, and if the line did not float it would be much more difficult to either keep the fly dry or to sail the fly accurately down over a feeding fish. Now, I will drown the fly. It is quite wet now, but just watch while I dry it. I make the forward cast—but well up in the air—and before the fly has time to fall on the water I make the back stroke again. I do this several times. Finally, I cast the fly—you see it is dry now—and it floats. Watch it.

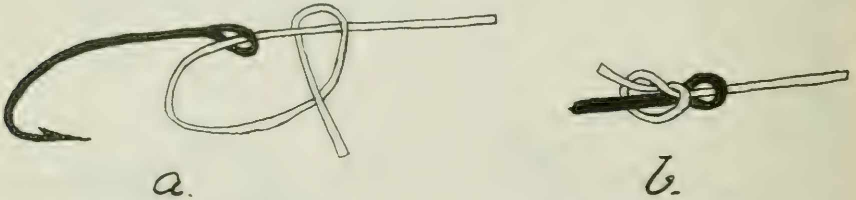

FIG. 32. A simple jam knot suitable for fastening a small fly hook to leader.

Tourist: That looks easy enough!

Angler: Would you care to try? But before you do, just watch me again and note that I allow the line to become fairly well extended both in front and behind before I make the next stroke. Then, too, I must caution you to make your strokes with deliberation and only to use the wrist and forearm when casting. Now try.

Tourist: Well, what happened then? What made the line strike the water?

Angler: You made your forward stroke too long. In other words, you should have checked the rod before it had gone very far beyond the vertical. Shorten the line a bit and try again.

Tourist: That is better. I seem to be getting on to it now. What was that splash over there, just below that willow?

Angler: That was a fish. We will let him have a few more real 'hoppers before we try him with an imitation one. Until the fish are feeding steadily, they are rather particular as to what they take, but as soon as they have taken a few 'hoppers without any accidents they are willing to look at a fly.

Tourist: Did you see that? He took another.

Angler: Let's crawl up and get a little closer to him—never cast an inch further than you have to. Now we are in position. Watch closely and see just where he takes down the 'hoppers. There, he got that one all right! Now, run your eye up along the surface for two or three feet and locate the spot where the fly should fall so that it will float over the spot where the fish took that last 'hopper. Well, that place up stream is where our fly must fall so that it will come down over Mr. Fish in a natural manner.

Tourist: There, he has taken another!

Angler: Well, here goes. We'll try for him. I make a preliminary cast in the air just above the surface to see if my line is long enough or otherwise. Not quite enough, so I will pull off a little more; that is about right. Now watch the fly. It is getting close. Yes! He has it!

Tourist: That is a good fish. See him jump?

Angler: Will you land the fish when I bring it in? Put the net well down into the water, and with one motion lift the net and scoop out the fish.

Tourist: All right, give me the net.

Angler: All ready? Here comes the fish.

Tourist: Say, that fish must weigh two pounds. Why don't you bring it in?

Angler: Never try to land a fish until it is all in, because if you do, in its struggles, it is very liable to catch the leader on the net and then it will break loose.

Tourist: How can you tell when the fish is played out?

Angler: Whenever you see a fish turn on its side, it is a sign that the fight is over. See that! He showed his side then. He is almost finished. Here he comes. Take your time and don't get excited. Well done! You've got it all right.

Tourist: Why do you knock the fish on the head?

Angler: To kill it. It not only puts an end to the fish's sufferings, but the fish will keep better.

Tourist: How much does it weigh?

Angler: One and a half pounds.

Tourist: Is that all? I should have thought it was fully two pounds.

Angler: You will notice now, there are many more 'hoppers on the water, and look, you can see fish feeding on them all up and down the river. See, there is a fish I want you to catch.

Tourist: Now, tell me just what to do. Where shall I drop the fly?

Angler: The current is a little stronger here, so you had better drop the fly about three feet above the fish. To be exact, just in line with that little willow shoot. But, before you make your cast just cast well off to one side, where there will be no danger of frightening the fish, so as to see how the line is for length.

Tourist: The fly has sunk. Why was that?

Angler: I expect you aimed at a spot on the surface, whereas, you should have tried to cast your fly in the air so as to strike a spot about a foot above the surface. Then, the fly would have fallen on the water gently.

Tourist: Will you dry the fly?

Angler: All right, but watch me closely. I throw the fly straight out in front, then back and keep it moving quickly. Now it is dry. Try again.

Tourist: That is in the right spot. Here it comes over the fish; no good.

Angler: You made a mistake then. When your fly has passed over a feeding fish without any notice being taken of it, let the fly float well down below the fish before you lift the line off the water.

Tourist: Shall I try again?

Angler: No, I guess that fish is scared. We will move on and try for that fish that has just made such a splash behind that weed. But don't try from above; get below the fish and cast up stream.

Tourist: How is this? I think I can reach him from here.

Angler: Take your time; wait till the fish has taken another 'hopper; then you can locate him exactly.

Tourist: There, he got that one, so here goes the fly.

Angler: Ah, that ought to get him. He's got it! But what did you do?

Tourist: The leader broke and the fly is gone.

Angler: I expect you struck too hard. Well, let us move down a bit while I tie on another fly.

When you strike a fish do not strike as though you wanted to throw the fish out; just make a slight upward motion with the rod and as soon as you feel any resistance check the motion; then, keep a tight line on the fish, but do not try to see how much strain the tackle will stand; just keep an even strain on the fish and keep the fish moving.

Striking is really the most difficult thing to become proficient in. If we were using ordinary gut, which is two or three times stronger than what we are using, it would be much easier to successfully hook a fish; but the stouter gut would be much more visible to the fish and in all probability we should not have many opportunities to strike at a rising fish.

Another thing to remember is this, big trout should not be struck as quickly as you would strike smaller fish. The movements of the larger fish are, to a certain extent, deliberate. As a rule, there are no very near neighbors who might snatch the tempting morsel away.

Whereas, a small fish has generally numerous relatives close by, all of whom are on the lookout for anything that looks good.

Now come carefully round this piece of brush and get down and crawl up towards the bank.

Tourist: Well, look at that fish, you can see the spots on him. Try and catch him.

Angler: Wait a minute; let's watch him feed; maybe we can learn something useful by watching him. If you notice, there is a patch of weed that comes almost to the surface. This restricts the stream and makes a little stretch of sharp current close under the bank. The fish keeps his position just at the lower end of this sharper stream and faces up stream watching for 'hoppers. Here comes a 'hopper. See the fish move a little to one side. Then see, just at the right moment he'll come to the surface and take it down.

Tourist: That certainly is a fine fish; look at him! Say, try and catch him.

Angler: All right, here goes. Well, did you see that? There was a real grasshopper a little nearer the fish than my fly was and he took that and never even noticed the fly.

Well, I'll try again when there are no real 'hoppers in sight to distract his attention.

Now is the time: watch the fly.

Tourist: Good, he's taken it.

Angler: Keep down; don't show yourself to the fish till you have to. You go down to that point of gravel and I'll bring the fish in. But don't stand up till you have the fish in the net.

Tourist: He is trying to get into those weeds.

Angler: Yes, he knows that once there, he has a good chance of getting off.

He's beginning to get tired now, but as this is a good sized fish I shall not bring him in until he is quite worn out.

See that? He turned on his side; but it's not quite time yet, he has straightened up again. However, it won't be long now. There, put the net down low in the water and I will bring the fish in.

Tourist: Say, that's some fish! See what he weighs.

Angler: Three and a quarter pounds, and only 18¼ inches long.

Now, I want you to catch something. Before we begin fishing again, I'll break the fly off and tie it on again.

Tourist: Why do you do that?

Angler: Because the gut has necessarily become weakened at the knot. Also you see how slimy and wet the fly is. It does not look as though it would ever be dry again. I'll just slam the fly onto the water and jerk it through a few times; that will wash the slime off. Next I'll press the fly between this little pad. It is almost dry now, but to complete the drying process, while we're walking down to the next feeding fish I'll make some false casts in the air. I am going to cast the fly on that shallow water. What did I tell you? It's absolutely 'bone dry' again.

Tourist: What is that little pad made of?

Angler: It is a piece of *amadou,* which is a fungus with the properties of absorbing moisture very rapidly.

Tourist: Something like blotting paper?

Angler: Yes, only with greater powers of absorption than any blotting paper that was ever made.

Now then, here is a fish you must get. There is just enough stream to ruffle the surface a bit, but it is a steady stream so that you can cast a straight line and not have any reason to expect a drag.

Tourist: What is a 'drag'?

Angler: A 'drag' is that which results from the line moving faster or slower than the fly. If a line is cast in such a way as to make the fly draw or pull against the current and thus leave a wake behind it, the fly is said to 'drag.' I dare say, you have observed that real flies and other insects hardly ever do this. A wary trout might just be on the point of taking a fly, but if the fly suddenly began to move across the surface leaving a track behind it, the suspicions of the fish would be aroused and in all probability he would have none of your fly. However, this fish is easy of access and there is not much danger of drag. Make your fly fall on the water about two feet above the spot where he took down the last 'hopper! Above all, when he takes the fly strike him gently, as though you loved him. Now go to it.

Tourist: That seems a good cast but the fish is taking no notice of the fly.

Angler: Wait a few moments before you cast again; if you are not in a great hurry wait until he has taken another real 'hopper.

Tourist: There, he took that one. I'll try him with the fly again.

Angler: Good cast. Keep your eye on the fly. Oh, he has it! Well done—you have hooked him.

Take your time. Don't get flurried. I will land him when you bring him in.

Tourist: He seems tired out, so make ready. Now, I'm going to pull him in toward you.

Angler: Well, well, that is certainly a nice fish—two and a quarter pounds—and the first you ever caught on a dry-fly.

Tourist: I shall have something to tell the rest of the party when I meet them tonight.

* * * * * * * *

Angler: It is only two o'clock, and the machine won't show up for another half hour. We have caught as many fish as the law permits, not large in numbers, but a full ten pounds; so while we are waiting for the machine I will give you a few more pointers.

As I have explained, the grasshopper fly, which we were using, floats on its side very much as the real insect does.

Water bred flies, on which trout feed, float on the surface with their wings up in the air. I will now put on an olive dun; we need not expect any fish to look at it, because they are far too much taken up with the grasshoppers at present.

Now, will you go up stream about forty feet and kneel down and watch the water closely?

Tourist: How will this do?

Angler: That is just about right. Now watch the surface; I will drop the fly about three feet from the bank. When you see the fly on the water tell me if you notice anything at all about it.

Tourist: Why, the fly is floating with its wings up in the air just like the real thing. How did you do that?

Angler: Now watch me make a cast. Instead of making the backward and forward strokes in a vertical plane, that is, the overhead cast which we used with the grasshopper fly, I make the strokes in a horizontal plane, which throws the line out sideways, and the fly curves around and for a moment the line, leader and fly are motionless over the water; then they fall gently, and the fly falling by its own weight naturally assumes an upright position and floats with its wings 'cocked up.'

Tourist: Why won't the overhead cast do that as well as the horizontal cast?

Angler: Because, no matter how carefully we cast, there is always the chance that the line will still have some slight momentum left in it from the cast; this motion, no matter how slight, may be enough to topple the fly over on its side. On the other hand, the horizontal cast throws the line out over the water, the line becomes extended and for a fraction of a moment all movement ceases, then gravity begins to act and the fly falls very lightly on the surface, as you have seen. Now come and try to do as I did.

Tourist: Let me see you do it again. All right, now let me have a try.

Angler: Try and see how close you can make your fly come to that little bit of rush that shows above the surface. You overshot the mark that time; the fly curled round too far.

Tourist: What made it do that?

Angler: You put just a trifle too much force into the cast. Try again.

Tourist: It was way this side of it. I guess I didn't cast quite hard enough that time. Ah! That is better. You try again.

Angler: This cast is much harder to do accurately than the overhead cast, but when you once learn it well, it is astonishing how simple it becomes.

Tourist: Why, the fly fell within three inches of the rush; I wish I could do that.

Angler: You will soon pick up the knack with practice, but watch this cast. This is the back-handed cast. It is the same as the horizontal cast only is made on the left hand side. The stroke somewhat resembles a back-handed stroke at lawn tennis, hence its name. It looks difficult, but comes just as easy as the other with practice.

Tourist: Well, here comes the machine, and I must thank you for a most enjoyable and instructive day.

Angler: I am glad you got some benefit from my teachings, and I hope you will become a highly proficient dry-fly man in the years to come.

Tourist: It certainly is a great sport. It has added to the charm of fly-fishing in a way that I thought hardly possible. I should like you to meet the rest of my party.

Angler: I will come over to the hotel after supper, about eight o'clock, but you had better take these fish, as there is just a chance that your crowd have not caught anything up at Pine Lake; even if they have, stream fish are always better eating than lake fish.

Tourist: Thanks very much. I have been hungry for trout for some time. Well, so-long till this evening.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

JULY 26, 1920.

"The man who illegally takes game or fish decreases food resources and defrauds his country."

A NEW EXECUTIVE OFFICER

Since our last publication Mr. Charles A. Vogelsang has succeeded Mr. Carl Westerfeld as Executive Officer of the Commission. This change is not regrettable in and of itself, for Mr. Vogelsang has had years of previous experience in the office he now holds, and has always enjoyed a deserved popularity for ability and zeal in the performance of his duties. No better appointment could have been made.

The only regret arises from the fact that Mr. Westerfeld's conduct left the Commission no alternative course except declaring his position vacant. A majority of the Board had long been convinced that a continuance of Mr. Westerfeld's services was not desirable. He became dissatisfied with his salary and devoted time due to the State to the maintenance and upbuilding of a private law practice and used the Commission's rooms and stenographer's services to that end. His lack of interest was soon reflected in the laxity of his subordinates; in view of which the majority of the Board came to feel that a change in the office of Executive Secretary was absolutely essential.

He was so advised and was accorded two months time in which to arrange for his retirement. At the end of that period, instead of resigning, he preferred public charges against Commissioners Newbert and Connell, the burden of which was that they were criminally responsible for the mishandling of State moneys. It was not, of course, charged that they had embezzled of misappropriated any of these moneys; that would have been too preposterous. The charge was that they did not remit to the State Treasury, month by month, all moneys arising from the sale of licenses, as the law requires.

The answer of the Commissioners was prompt and complete—that they had deposited these various license funds when, and as they actually became State funds—that canners' licenses, kelp and fisheries tonnage taxes, sold directly by the Commission, were remitted upon receipt; but that hunting and angling licenses, retailed for the greater convenience of sportsmen through a large number of so-called "Resale Agents," were only to be considered as State funds after final settlements with such agents, as they were entitled to refunds for all licenses returned unsold, and their commissions could only be computed upon their actual sales. In this interpretation of the law and of their duties, the Commissioners were wholly justified and fully exonerated by an opinion of the Attorney General of the State delivered in response to the Governor's request for a construction of the law.

Manifestly, but one course was open to the Board after such a baseless attack by a subordinate, and Mr. Westerfeld was ousted from office.

F. M. NEWBERT.
M. J. CONNELL.

OPTIMISM VERSUS PESSIMISM.

We all admire the optimist, the man who believes that all is going well in spite of adverse conditions, but sometimes an "all's well with the world" attitude develops apathy and a disregard of the need of readjustment or reform. There are many sportsmen who, in spite of circumstantial evidence, glibly point out that game conditions are of the very best, that game is continually on the increase, and that there is no need for worry as to the future. Too much of this sort of optimism prevents an awakened public sentiment which would be favorable to an improvement of conditions.

Although pessimism may sometimes mean a reduction of income from the sale of hunter's and angler's licenses, yet pessimism in regard to future game conditions often stirs the public to action. Certainly a study of the game situation in our state would convince anyone that action rather than apathy is the present day need, in so far as fish and game conservation is concerned. We are inclined to believe that there is greater danger toward fish and game in the optimistic point of view than in the pessimistic point of view.

THE VALIDITY OF THE MIGRATORY BIRD TREATY SUSTAINED.

On April nineteenth of this year the United States Supreme Court sustained the validity of the Migratory Bird Treaty, a treaty which was made between the United States and Great Britain for the protection of migratory birds in the United States and Canada. It also declared the Migratory Bird Treaty Act constitutional which was approved July 3, 1918, to carry out the provisions of the treaty. Those who have appreciated the need for this law rejoice that it has finally been declared constitutional.

As early as 1904 Hon. George Shiras 3d introduced a bill which was defeated. But on March 4, 1913, the Weeks-McLean bill was brought before Congress through the efforts of the Interstate Sportsmen's Protective Association. This association necessarily took an important part in the fight.

The Weeks-McLean bill provided that the United States Department of Agriculture should have the right to make regulations for the taking of migratory birds of all kinds. The principal attack made on this new bill was by some of the Middle Western States, Illinois being one of the most prominent. The argument made against the bill, by Illinois and other states affected, was that it practically eliminated the sport of duck hunting except for those living on the big rivers and lakes, unless there was a great sufficiency of water during the fall season, an entirely uncertain factor. The Weeks-McLean bill was attacked in the Federal Courts and was held to be unconstitutional by several of the judges in the United States District Courts, with the result that the government having been appealed to, from the adverse decision in Arkansas, the case eventually reached the Supreme Court. While the act was under discussion the treaty was made between the United States and Great Britain for the protection of migratory birds in the United States and Canada. This treaty was enacted by Congress and after the law went into effect the federal government dismissed the appeal in the Supreme Court, as the old act was supplanted by the new one.

Before further discussing the Migratory Bird Treaty, a brief summary of the provisions of the treaty is inserted as follows:

(1) The close season on all migratory birds in both countries is between March 10 and September 1.

(2) No open season can exceed three and a half months.

(3) The season is closed the year round on all migratory insectivorous birds.

(4) It is unlawful to sell wild ducks and other water-fowl in the markets in either country.

(5) It is unlawful to rob the nests of the ducks, etc., in Canada.

Returning to the Migratory Bird Treaty Act and the final settlement in the Supreme Court; on July 2, 1919, application was made before Judge Arba S. Van Valkenburgh of the United States District Court, at Kansas City, Missouri, for a restraining order to prohibit United States game wardens from enforcing the Migratory Bird Treaty Act in that state. Judge Van Valkenburgh refused. Acting under the authorization of a joint resolution adopted by both branches of the legislature, Attorney General McAllister brought this case of the *State of Missouri*, Appellant, vs. *Ray P. Holland*, United States game warden before the Supreme Court (No. 609, October Term, 1919). It was on this case that the Supreme Court, sustaining the decision of the lower tribunal, handed down the concluding sentiment which determined the constitutionality of the Migratory Bird Treaty Act. McAllister, leading the fight against the act, maintained that it trod on the rights of the state. The opinion of the court as delivered by Justice Holmes reads as follows:

> "The state, as we have intimated, founds its claim of exclusive authority upon an assertion of title to migratory birds, an assertion that is embodied in statute. No doubt it is true that as between a state and its inhabitants the state may regulate the killing and sale of such birds, but it does not follow that its authority is exclusive of paramount powers. To put the claim of the state upon title is to lean upon a slender reed. Wild birds are not in the possession of anyone; and possession is the beginning of ownership. The whole foundation of the state's rights is the presence within their jurisdiction of birds that yesterday had not arrived, tomorrow may be in another state and in a week a thousand miles away. If we are to be accurate we cannot put the case of the state upon higher ground than that the treaty deals with creatures that for the moment are within the state borders, that it must be carried out by officers of the United States within the same territory, and that but for the treaty the state would be free to regulate this subject itself."

In further answer to Attorney General McAllister's stand, and concluding the delivered opinion of the court, Justice Holmes said:

> "The treaty in question does not contravene any prohibitory words to be found in the constitution. The only question is whether it is forbidden by some invisible radiation from the general terms of the Tenth Amendment.
>
> Here national interest of very nearly the first magnitude is involved. It can be protected only by national action in concert with that of another power. The subject matter is only transitorily within the state and has no permanent habitat therein. But for the treaty or the statute, the reason might be no birds for any power to deal with. We see nothing in the constitution that compels the government to sit by while a food supply is cut off and the protectors of our forests and our crops are destroyed. It is not sufficient to rely upon the states. The reliance is vain, and were it otherwise, the question is whether the United States is forbidden to act. We are of the opinion that the treaty and statute must be upheld."

The decree was affirmed, Associate Justices Van Devanter and Pitney dissenting.

SURVEY OF THE FUR-BEARING MAMMALS OF CALIFORNIA.

Many readers of CALIFORNIA FISH AND GAME who do more or less trapping each year will be directly interested in the announcement that on December 1, 1919, the Museum of Vertebrate Zoology of the University of California began an investigation of the fur-bearing mammals of the state. The purpose of the investigation thus undertaken is to secure reliable information as fully as feasible concerning the food, breeding habits and all other points worth knowing in the natural history of our fur-bearers. It is believed that this information is especially desirable at this time so as to determine the economic status of the various species, this being in many cases in doubt to ascertain the annual catch which may be safely taken without endangering the present breeding stock, and further to furnish an adequate basis for sound constructive legislation that will protect and develop the fur resources of our state. The income to the trappers of California from this source now amounts to nearly $400,000 annually.

All wild mammals of California whose pelts are commonly sold for fur are to be considered as fur-bearing mammals in this investigation.

Arrangements have been fully made, and the work is already well under way. Mr. Joseph Dixon, Economic Mammalogist of the above named institution, has spent a large part of the past trapping season visiting the trappers of the state and in securing first hand information relative to fur-bearing mammals. Diagrams to scale, measurements and photographs of breeding dens, notes on life history, together with photographs of the living animals in the wild have already been secured of several of our most important fur-bearers.

Blank records have been sent to the most progressive trappers of the state and these men have responded heartily. Many of them have examined the stomach contents of all the animals that they have trapped, so that we now have, in addition to field notes and collections gathered during the past eleven years by the Museum of Vertebrate Zoology, as a foundation to go on, over 350 definite records, from these reports of food found in the stomachs of practically all the common fur-bearers in this state. The trappers have also sent in all available records of females that they have trapped which have contained embryos (unborn young). This affords an accurate index to the time and rate of breeding of these animals and has a direct value in determining the date when the trapping season should close in order to "protect the crop" for the succeeding trapping season.

An important feature of recent field work has been the taking of paraffin casts of tracks made by live wild animals under natural conditions in the field. Such a cast faithfully reproduces every dimension and contour of the original track and thus affords an excellent idea of one sort of "sign" which may be looked for by trappers

It is expected that at least three years' work will be required before the results of the investigation will be ready for publication. It is planned that this shall be in book form. Arrangements have been made to have this volume illustrated with color plates by America's foremost animal artists. Chapters in the book will be devoted to decrease of fur-bearing mammals, causes and control of this decrease, the fur trapper in California, methods of trapping and curing furs, legislation relative to fur-bearing mammals, agricultural and game interests versus fur interests, and federal and state forest reserves as permanent producers of fur-bearing mammals.

A general account of each species is being planned for, under which will appear topics such as common and scientific names, marks for field identification, description of pelage, moult, coloration, pads, claws, measurements, weights, skulls, teeth, variation, general distribution, type locality and specimens examined. Other topics, such as mannerisms, gait, posture of body, instances of behavior, timidity, voice, tracks and other sign, sanitation, breeding dens, breeding seasons and habits, number of young in litter, time of birth, precocity of young, paternal care, enemies, nature of food (exact data), feeding and forage habits, relative abundance, estimates of population, changes within history, relation to agriculture, grazing and forestry, and economic status, will be treated in detail.

Suggestions, information and observations of special interest will be welcomed from the readers of CALIFORNIA FISH AND GAME. In order to be of most value, the locality, date, and name of the observer must be given. Address communications to

Museum of Vertebrate Zoology,
University of California,
Berkeley, California.

ADEQUATE GAME PROTECTION.

What will make for better game protective measures throughout the United States is a question which concerns all of the people of the United States who are interested in the conservation of wild life. The *Pine Cone*, the official bulletin of the New Mexico Game Protective Association, in the issue of March, 1920, states that either the inadequate, conventional methods of game protection, in vogue in practically every state in the Union, must go, or the game must go. This is rather too radical a statement, but it is generally conceded that there is a vast need for improvement in the individual state game protective departments of the United States. There are three fundamental precepts which are applicable to the state game departments in general, and which, if striven for, and earnestly adhered to, would assuredly do much to not only solve the problem of more adequate wild life conservation in each state, but would perfect the appended system to the national department on conservation. They are as follows:

First—The slogan in every state should be, "Conservation through education."

Second—Plenary powers should be granted the commissions or departments concerned with game regulation and wild life resources, not with the idea of giving more power, but of avoiding the necessary delay entailed by state legislation. This point is aptly exemplified by again quoting from the *Pine Cone*: The state department of health is a commission to which the state legislature has delegated extensive authority in regulating public health—such as making rules for the sanitary handling of milk, closing public meetings in time of epidemic, etc. Suppose during the influenza epidemic, we had had to wait for a meeting of the legislature before closing public meetings. Yet that is no more illogical than waiting for a legislative enactment to close the season on a species immediately threatened with extermination." And

Third—Departmental duties and discretionary powers should be conscientiously executed. Particularly with regard to—

(1) The granting of permits.

(2) The practice of quantitative distribution of licenses.

(3) The setting aside of game sanctuaries proportionate to the requirements of the state.

In California it is worthy of note and emphasis that 3,107,520 acres—27 game refuges by legislative enactment, 3 game preserves by the Fish and Game Commission, 5 bird reservations, and the national park areas by the federal government—have been set aside where no hunting is allowed, and where game is allowed to breed unmolested. This is, as has been stated before, roughly speaking, about 3 per cent of the total area of the state.

It is by constructive methods, therefore, that the goal of adequate wild life conservation will be reached.

A NATIONAL COMMISSION ON THE CONSERVATION OF WILD LIFE.

In the *Review* of April 17, 1920, there is an editorial suggesting the value of a national commission on the conservation of wild life. The *Review* makes the following statements:

"Good legislation in some narrow corner of the field results, now and then; but permanent advances along the entire line is impossible, so long as the matter is handled in a piecemeal way."

It is very true that greater cooperation in the work of conservation is needed, particularly in the consideration of effective methods of dealing with the problem of migratory species. The starting point for this work is conservation by education in the different states, and from this will develop united public sentiment and greater national benefits.

The United States Bureau of Biological Survey under the United States Department of Agriculture may be considered as the present national organization for the conservation of wild life. It is the beginning of what must necessarily be an actively growing institution. However, notwithstanding the unquestionable value of the United States Biological Survey, a commission would doubtless have much more freedom than the present United States Bureau has, and with a competent, fit body of men, might be able to accomplish more.

The vital point which still remains is that any central commission or national body, no matter how efficient in itself, would be more or less ineffectual unless it has the support of the individual states. Therefore, the effort of each state should be toward education which would lead directly to a cooperative spirit and the unification of endeavor. Without educational methods there will be more chance for misguided legislation, lobbying, aggressive criticism and the accompanying lack of coordinated national strength.

The conclusion is that the idea of a national commission is of paramount interest, but any national organization will be greatly hampered until it has creditable state support.

GUNS USED BY DUCK PIRATES.

Although few of the big guns used by the duck pirates, or night gunners, on Chesapeake Bay and the rivers of Maryland, are in use at the present time, yet occasionally a new capture is made. The collection photographed is a collection which has been assembled from time to time by the game wardens of Maryland. The guns measure 10 feet and weigh about 115 pounds; they are very crude affairs, some of them having been made by the "village blacksmith." Like guns were used by market hunters in California until legislation prohibited their use.

WM. H. FISHER,
Baltimore, Md.

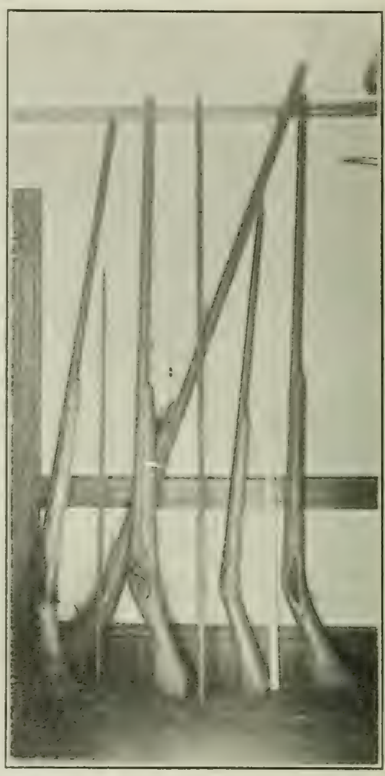

FIG. 33. Large bore guns used by duck pirates on Chesapeake Bay, Maryland. These are similar to those used by duck pirates in California previous to protective laws which put them out of business.

SALMON FISHING AT MENDOTA WEIR.

Prior to the last two decades, salmon fishing in the upper waters of the San Joaquin River was confined to the use of seines and spears. Following closely on these methods came the grabhook. This latter method could not be employed until some barrier was constructed which would interfere with the passage of the salmon toward their spawning ground. When such a barrier was devised the fish congregated in large numbers and thus became endangered by two methods of capture. Either, due to their attempts to leap the obstruction, they became a mark for the spearsman, or while massed below a weir under water they became the unseen target for the unscrupulous—so-called—sportsmen, or avaricious fish vendor, neither class caring what method they employed of catching the fish so long as they got them.

In about the year 1910 or 1911, the legislature of California attempted to check the use of grabhooks, but in framing the law, the wording of the protective section has proved to be inadequate. The section which has been the source of many bitter controversies between the officers of the law and the fellow who wanted the fish reads as follows:

"Section 634. Every person who, except with spear or hook and line, said hook and line to be used in the manner commonly known as angling, takes, catches or kills any salmon * * * is guilty of a misdemeanor."

In so far as I know, we have no court interpretation on this section, so the matter is still in dispute.

Passing from the illegal methods of taking salmon resorted to by the unscrupulous fisherman, we have the spoon hook and line method practiced by the many clean true sportsmen, some of whom come from distant places in the state to take salmon. And not infrequently, the sportsman of this type is rewarded by a big fellow taking the spoon in his mouth, which results in a fight that will often last for a half an hour or an hour. Thus the angler is rewarded by a sportsmanly encounter which keeps him on keen edge until the salmon is landed.

Why salmon strike at a spoon is not really known, for they apparently take no food after entering a freshwater stream, the stomach becoming useless so that food would probably not digest even if introduced artificially into the stomach. Then, we are prone to ask, "Why does he strike?" His known fighting qualities and unbounded determination to reach his recognized spawning bed may be an explanation for his actions. One seldom ever hears of a salmon taking a spoon until after he passes the town of Firebaugh, which leads to the inference that he apparently does not strike a spoon, after leaving the sea, until he meets with interference on his journey to his spawning bed. The town of Firebaugh is some six miles below Mendota weir, and very few salmon are taken on hook and line outside of a mile or two down the river, from the latter town. But at the weir, I have noted more than a hundred fish taken in twenty-four hours, fairly caught in the mouth with spoon hooks.

Those salmon which pass the weir travel up the river and pay little heed to lures of any kind, until they reach their final homes or spawning beds, in and near the hills. After reaching the cobble bottoms where they deposit their spawn, they again strike the spoon hook; at this time they furnish the greatest sport for the rod-casting enthusiast. Not only is the angler kept constantly on the alert, but he can find plenty of salmon pools wherein he can "let fly" one hundred and fifty feet of line and then some. The good fishing usually extends from the period prior to the time that they deposit their eggs until sometime in September; but individual salmon continue striking even on through the winter months.

Unless further protection is extended to the salmon very soon, the thrill of a salmon strike in the San Joaquin will be history. We have been very properly forced to give up the fall run of salmon to the agriculturist, and now our spring run is being depleted very rapidly. We lose vast numbers of fry in the irrigating ditches, as they travel down toward the sea. Therefore, unless we extend our best efforts to protect these fish quickly, the salmon of the upper San Joaquin River will pass into history as our elk and antelope have done.

S. L. N. ELLIS.

CHEAP SPORT FOR INFLUENTIAL VIOLATORS.

There is many a man who would gladly pay $5 for the privilege of killing a Canada goose, provided he was sure that this was the only penalty he must pay and that he would not be prosecuted and branded as a man unwilling to play fair with his brother sportsmen. Yet there are men in this country today who are enjoying this privilege, or rather stealing it, at the low rate of $2.50 per violation. It was only as recently as September 23, 1919, that William F. Taubel, a wealthy citizen of Riverside, New Jersey, was fined $5 by a United States District Court in Trenton, New Jersey, for violating the Migratory Bird Treaty Act, in that he decoyed to a blind and killed two Canada geese. Since that time the same judge who imposed the fine in the Taubel case has fined other violators of the same law as low as $2.50.

These fines contrast rather glaringly with a fine of $1,000 imposed on October 22 of the same year, also in Trenton, New Jersey, on Emilo Trowti, an alien resident of West Amwell, New Jersey. Trowti was found guilty of violating the New Jersey game laws, and was surely deserving of his punishment, as he was caught with a bag containing forty-eight song and insectivorous birds. However, fines similar to the first ones will surely cheapen the federal law and make difficult the enforcement of the Migratory Bird Treaty Act.

It is gratifying to know that other district judges in the United States do not share the views of the one who imposed these low fines. In Wisconsin three hunters were recently fined $100 each for attempting to kill ducks after sunset, while in Connecticut a violator was sentenced to three months in jail for a violation of the Migratory Bird Treaty Act. It is only by stringent methods that the true intent and meaning of this act can be carried out.

WATCH FOR BANDED DUCKS.

All waterfowl should be carefully examined to ascertain whether or not they are banded. The Bureau of Biological Survey, United States Department of Agriculture, Washington, D. C., and several individuals are making a practice of banding waterfowl, to ascertain their migratory lines of flight, and it is quite necessary that full reports regarding the taking of any banded bird be made to the proper authorities.

QUAIL IMMUNE TO STRYCHNINE POISONING.

Important evidence has been secured regarding the comparative immunity of quail to strychnine poisoning. Field observations and feeding experiments conducted in California showed that one valley quail can eat grain containing enough strychnine to kill 12 ground squirrels without showing the slightest ill effect from the poison. A number of similar experiments on a mountain quail and a bobwhite gave like results. The information thus gained will tend to allay fears in certain quarters that poisoning campaigns against ground squirrels result disastrously to these valuable game birds. Investigations in Saskatchewan, Canada, have proved that grouse are equally immune to strychnine poisoning. *Ann. Rpt. U. S. Dept. Agric.*

BIOLOGICAL SURVEY TAKES OVER WORK OF AMERICAN BIRD-BANDING ASSOCIATION.

The Bureau of Biological Survey, U. S. Department of Agriculture, Washington, D. C., has taken over the work, good will, effects, and records of the American Bird Banding Association, formerly conducted from headquarters at the American Museum of Natural History in New York City. In the future, therefore, the issue of bands and information relative to the work will be from this office, to which all records of birds banded and recovered, should be sent. There will, of course, be no further dues or initiation fees.

In taking over the work of this association, the Biological Survey is particularly desirous of retaining your hearty cooperation, upon which a large part of our success will depend.

The work is to be advanced along two principal lines: first, the trapping and banding of waterfowl, especially ducks and geese on both their breeding and wintering grounds; and second, the systematic trapping of land birds as initiated by Mr. S. Prentiss Baldwin. By maintaining volunteer trapping stations at intervals over the country, and consistently operating them throughout the year, a mass of valuable data relative to the migration routes, speed of travel, and affinity for the nest site of the previous year, as well as a quantity of life history information about the individual will be acquired.

To do this with any degree of success, the observer should be advantageously located with regard to bird habitats, as it is obvious that traps can not be regularly visited if located at any considerable distance from the operator's usual station during the day, and it is imperative that they be visited at least two or three times daily to prevent the birds captured from injuring themselves against the wires. The fascination of the work, however, will amply repay anyone for the little time and trouble, and for the expense for traps and baits.

Experiments are now under way to determine the most suitable types of traps and the best methods of trapping; and arrangements are being made for a supply of bands.

In the meantime, however, the Biological Survey desires to invite continued cooperation and will welcome any inquiries or suggestions for the advancement of the work. The Bureau particularly desires to get in touch with those advantageously located for the establishment of trapping stations.

NEW ZEALAND ENCOURAGES FISHING INDUSTRY.

Recently the Industries Committee, of the House of Representatives of New Zealand, traveled throughout the Dominion to find out how new and budding industries might be assisted and encouraged. The fishing industry amongst others was investigated and the following interesting recommendations were made:

That the best way to bring about the development of the industry is by organization for catching, distributing and, where necessary, preserving the fish. The only way to provide adequate supplies and prices within the reach of all is by trawling.

It recommended that a separate fisheries department of the government be established with a director and staff.

That the government own and operate steam trawlers, and establish fish-chilling and ice-making plants near the fishing grounds and engage generally in the business.

That the government advances be made to fishermen on the security of their boats and fishing outfit.

That the fishermen's boats be insured by the state office at a low rate.

That a systematic, scientific and practical survey of fishing grounds be undertaken without delay, and that the government purchase a properly constructed and equipped vessel for this work.

That government assistance be given to encourage the canning, curing and commercial preparation of fish food, special attention being given to the canning of crayfish.

That encouragement be given for the manufacture of fish manure and the production of fish oil (other than whale oil).

Several recommendations were made for licensing and controlling the business of whaling, among which were (1) that the whaling company should give guaranty that every portion of a whale's carcass will be used, and (2) that each company be confined to sixty miles of coast and each must take at least a certain number each year.

KARAKUL SHEEP INDUSTRY.

A few years ago considerable publicity was given the fact that some karakul sheep, noted for their fur, had been imported from Siberia. Added interest now pertains to this importation because of the fact that some of the original imported stock has been moved to California from Texas. The Kerman Karakul Sheep Company secured 200 animals from Texas in 1918, and the herd is now considerably larger. The outstanding importance of this breed lies in the splendid fur which is produced. It now appears also that this breed will do well even on scanty alkali vegetation. The karakul sheep will stand on its hind legs and browse high up, and therefore needs less territory as range. The lambs grow rapidly, sometimes attaining a weight of sixty pounds in two months. The mutton has a peculiar gamey flavor, and the large amount of fat (about twenty pounds to each animal) is valuable. According to P. A. Ingvason, manager of the ranch at Kerman, a better and hardier sheep is obtained by crossing the karakul with a Mexican wool sheep.

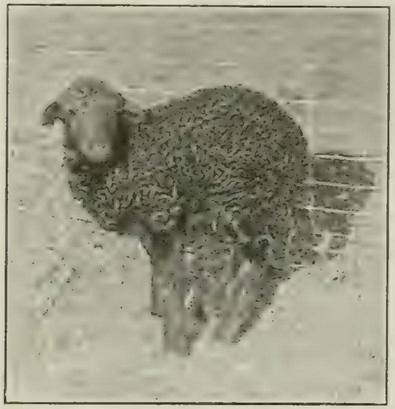

FIG. 34. Karakul lamb showing fur in prime condition. The Karakul sheep industry has spread to California.

A new fur industry is therefore being developed in California. Although the animals utilized are domesticated, yet the increase of furs of this sort should add much to reduce the toll taken of native fur-bearers, and consequently this new project should be looked upon with favor.

SUGGESTED BIRD RESERVATION ON MONO LAKE.

A colony of gulls is located on a large island in Mono Lake where it is customary for them to breed each year. Recently a desert homestead has been taken up with an entry on the lake, and a summer residence has been built there. I understand that the homesteader proposes to stock the island with goats, which may be a fad that will be short lived. However, it strikes me that some attention should be given to the preservation of this colony of gulls, which is somewhat unique on account of the fact that it is situated so far inland, and also because it adds greatly to the interest taken in the Mono Lake region. This territory is rapidly coming to the front among the tourists as a recreation ground, and I feel that all due precaution should be taken to retain the interesting features of the locality. I have had it in mind for some time to advocate the setting aside of a sufficiently large portion of this island as a bird reservation, to insure their continued residence, through the aid of due protection.

No doubt you will be interested in this case, and if you care to take it up further, I will be glad to do all in my power to assist you in the matter. It is quite evident that unrestricted goat raising on the island would have a disastrous effect on the birds.

W. W. MAULE.

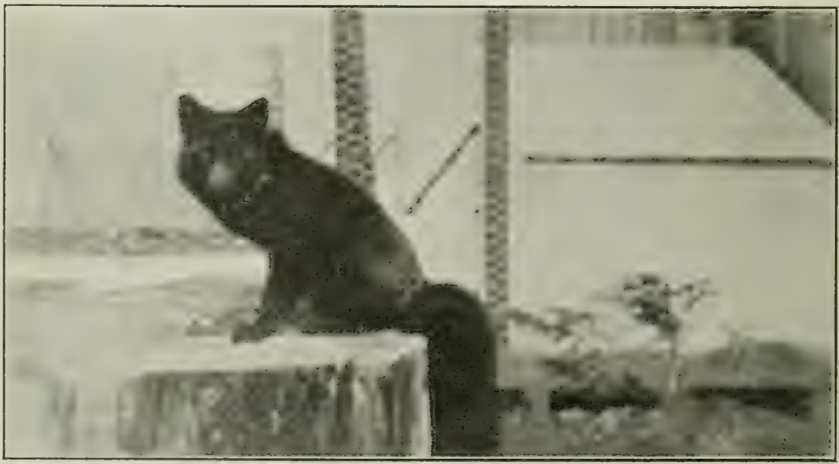

FIG. 35. Black fox at Tahoe Fox Farm.

FOX FARM A SUCCESS.

The foxes at the fox farms of Lewis and Kierman, situated near Pomins, Lake Tahoe, are doing splendidly. The snow and cold, moist atmosphere at Lake Tahoe puts the fur in prime condition. The accompanying photograph is a picture of "Tahoe Queen," a black silver fox at the fox farm of Lewis and Kierman, which is valued at $3,000. The results thus far have been so encouraging that Lewis and Kierman are contemplating enlarging their fox farm of silver black foxes. JOSEPH H. SANDERS.

DEER PROTECTION IN SISKIYOU COUNTY.

There is nothing so abhorrent to the true sportsman as the wanton slaughter of deer, and especially the ruthless killing of a doe. One morning in March, 1919, the writer came upon a spectacle of this kind which so aroused him that he is prompted to utter a protest against such butchery. He was riding on horseback through the winter range for mule deer in Siskiyou County, which extends from the Weed Big Springs road as far north as the foot of Goose Nest Mountain and as far east as Morrison Station on the Klamath Falls line. In this section there are several hundred deer that come from the higher mountains and even from the lava beds to winter. There was about one inch of snow on the ground. Suddenly there appeared in the snow a blood trail with a man's track following. The writer determined to investigate. He did not have far to go when he came upon a sight that made his blood boil. There under a little bunch of pines he found the head of a mule doe and nearby two unborn fawns that the violator had taken from her. It was late in the evening and the writer had no kodak. When he returned next morning to get a picture he found that the coyotes had been there in the night and nothing remained.

This, however, was not the first slaughtered doe that the writer has found. The previous year on this same range he had come upon a mother and two yearling fawns, both does, wantonly killed and left for the coyotes. Furthermore, almost every day of the week shots may be heard in this section and evidence found of deer killed out of season. Game hogs have even gone so far as to build roosts in the trees, that they may have a better vantage point to watch the runaways.

In view of the conditions existing on this range it would almost seem advisable that a special patrol be established here from the first of December until the first of May, by which time the deer will have gone back to their summer ranges and can protect themselves.—EDWIN H. BUSCOMB, Edgewood, California.

BIRD CENSUSES.

In order to better regulate national affairs it is necessary to know the population from year to year so that fluctuations may be noted. Hence the ten year census. Likewise if we would control bird and animal life to better meet our needs it is necessary to obtain figures as to the wild life population. A number of states have recently inaugurated game censuses and the United States Biological Survey is advocating bird counts to gain knowledge of the total bird population and its fluctuations from year to year. Reliable observers the country over are being sought to undertake bird counts during the nesting season and to forward reports. In the hope that some of our readers may be interested in the work, and to show the thorough manner in which the work is undertaken, we are adding the following directions issued in Washington:

> The height of the breeding season should be chosen for this work. In the latitude of Washington, D. C. (latitude 39 degrees), May 30 is about the right date for the first count; in the latitude of Boston the work should not begin until a week later, while south of Washington an earlier date should be selected. In any locality the count should be made soon after the end of the migration and during the early part of the nesting season.
>
> What is wanted is a count of the pairs of birds actually nesting within the selected area. Birds that visit the area for feeding purposes only must not be counted, no matter how close their nests may be to the boundary lines.
>
> In making this count, it is a good plan to begin at daylight some morning at the height of the nesting season and zigzag back and forth across the area, counting the male birds. Early in the morning every male bird is usually in full song, and at that season may safely be considered to represent a breeding pair. The results of one day's count should be checked and revised by several days of further work to make sure that every bird

counted is actually nesting within the area and that no species has been overlooked.

The tract selected should represent the average farm conditions, and should not have an undue amount of woodland. It should contain not less than 40 acres—a quarter of a mile square—nor more than 80 acres, and should include the farm buildings, with the usual shade trees, orchards, etc., as well as fields of plowed land and of pasture or meadow.

The final results of the count should be sent to this Bureau as soon afterward as convenient, and should be accompanied by a statement of the exact boundaries of the selected area, so explicitly defined that it will be possible 25 years hence to have the count repeated. The name of the present owner should be given, together with a careful description of the character of the land, including a statement of whether it is dry upland or moist bottom land; the number of acres in each of the principal crops, or in permanent meadow, pasture, orchard, swamps, roads, etc.; the kinds of fencing used; and the amount of brush along fences, streams, roads, or in permanent pasture.

If there is an isolated piece of woodland comprising 10 to 20 acres conveniently near, a separate count of the birds nesting therein also will be useful. In this case the report, in addition to specifying the size and exact boundaries of the area, should state the principal kinds of trees and whether there is much or little underbrush.

A third count desired is of some definite timbered area—40 acres, for instance—which is part of a much larger tract of timber, either deciduous or evergreen.

Still a fourth count, supplementary to these, is needed. The average farm in the Northeastern States contains about 100 acres, and the average count hitherto has been of the birds nesting on the 50 acres of the farm nearest to and including the farm buildings. It is now necessary to obtain counts of the remainder of the farm, the wilder part containing no buildings, especially on the same farms where counts about the buildings have already been made.

Furthermore, counts on any other kinds of land are much desired for comparison.

Persons who have made counts in previous years are requested to repeat the work on the same areas. New areas selected should be such as are not likely to have their physical conditions much changed for a number of years. If succeeding annual counts show changes in bird population, it will thus be known that they are not due to changed environment.

The several kinds of counts are needed for a study of the relative abundance of birds under changing or stationary conditions. It is hoped that many persons interested in bird life will make one or more counts this season. As the department has no funds to pay for this work, it must depend wholly on voluntary observers. A supply of report blanks will be furnished on request. Requests for these should be addressed to Chief, Bureau of Biological Survey, U. S. Department of Agriculture, Washington, D. C.

BEAR PROTECTION FAVORED.

It is reported that interest in black bear protection is always increased at the time of a blackleg epidemic in that the bears can be depended upon to eat up cattle which have died from blackleg, thus helping to prevent the spread of disease. Residents of Tuolumne County in past years have been wide awake to this benefit conferred by the black bear.

FACTS OF CURRENT INTEREST.

Work on the new $30,000 Tahoe Hatchery was resumed May 1 and it will be ready for occupancy August 15.

* * *

Ray Morris of Taft, California, was tried on March 10, 1920, on the charge of having deer in his possession during the closed season. He was sentenced to thirty days in jail and fined $250.

* * *

Floyd E. Baker of Los Angeles was caught by Deputy Ober in Nine Mile Canyon, Inyo County, while attempting to leave the mountains with twenty-four deer hides and nine sets of antlers which he had secured in Tulare County. He was tried April 27, and sentenced to 150 days in jail and a fine of $350.

* * *

Low water conditions have precluded a large take of rainbow trout eggs this season. At some of the best egg collecting stations but small takes of eggs have been secured.

* * *

The Fish and Game Commission has carried its educational campaign into the summer resorts of the state. In cooperation with the National Park Service, lectures and field trips are being furnished visitors to Yosemite National Park.

* * *

According to records kept by deputy game commissioners and forest employees, 1243 deer were killed in Trinity County during last year. It is estimated the total number was at least 2000, as many hunters come into the county during the hunting season and kill deer, records of which are never kept.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

On April 30, the application lists for fish for the season of 1920 were closed. Prior to this date application blanks had been forwarded to all sections of the state, in order that interested parties might have ample opportunity of filing applications for fish for the purpose of stocking all streams open to the general public for fishing purposes. The applicants were cautioned that it was very necessary to have their formal applications on file in the office of the Department of Fish Culture prior to the date of closing, in order that they might be assured of receiving a supply of trout fry this season.

Nearly five hundred applications were received, and they came from every section of the state where conditions are favorable for the planting of trout fry. The majority of the applications were received from private individuals, although there were also a considerable number received from boards of supervisors, chambers of commerce, public associations of anglers and fishing clubs.

The season just closing has been a very unfavorable one for collecting trout eggs. Every egg collecting station was in operation this season and every effort was made to obtain a larger number of trout eggs than ever before, as it was realized that the demand for fry would be greater than ever before in the history of the Commission. The completion of the hundreds of miles of new highways and the ever increasing number of anglers is in large measure responsible for the increasing demand.

The drought of the past winter and early spring made it very difficult to obtain even a fair take of eggs at some of the best stations. The streams were so low in some sections that the spawning trout could not possibly ascend the streams to the points at which the egg collecting stations are located. This condition was noticeable at the Snow Mountain Egg Collecting Station on the Eel River, where in normal seasons from four to seven million steelhead eggs are obtained. This season less than one million eggs were taken at this station.

The run of fish in Scott Creek where the Scott Creek Egg Collecting Station is located, was also far below normal and less than half the usual number of steelhead trout eggs were obtained.

In the Bear Lake section, in San Bernardino County, where new racks, traps, holding tanks, etc., have been installed on the streams tributary to the lake, the take of rainbow trout eggs was practically a failure. Where there was every reason to expect a take of from four to six million eggs, only one and one-half million were obtained. In this section the long drought was followed in the early spring months by heavy snows and stormy weather. As the season advanced water in the lake was comparatively warm, while the streams flowing into the lake ran bank full of cold, roily water from the melting snows in the surrounding mountains. Under these conditions the spawning fish, which had gathered close to the mouths of the creeks, would not enter the streams to spawn except in limited numbers. Over retention of the eggs resulted and consequently when the fish were taken in our traps, the majority of the eggs were impossible of fertilization.

At the Klamath River stations in Siskiyou County there was a fair run of rainbow trout and a fair take of eggs was obtained.

Conditions at the Almanor Hatchery in Plumas County were unfavorable for egg collecting operations and we were unable to take any eggs at the station. A fair take, however, was obtained at Clear Creek Hatchery and the Domingo Springs Hatchery promises to turn out a million or so of rainbow trout eggs.

The water levels in Lake Tahoe were far below normal this spring, and while the season has not closed at this writing, it is extremely doubtful if more than a third of the normal take of black-spotted trout eggs will be obtained.

Our extensive system of breeding ponds at the Mount Shasta Hatchery has, however, produced a fine large take of Loch Leven and brown trout eggs and also a nice lot of eastern brook eggs. These eggs have all been hatched, and the resulting fry are thriving well and will soon be ready for distribution.

Under these conditions it will be readily seen that the number of trout fry available during this coming season will be less than during several previous years, and consequently the allotments to the various applicants will be materially less than usual.

Two distribution cars will start out with fish about the middle of June, and applicants are urged to take every precaution to insure the safe delivery of all the fish allotted to them.

Applicants are instructed to make proper arrangements for meeting the fish cars promptly on arrival of the train as scheduled, provided with adequate transportation to handle the fish from the station to the streams to be stocked. Also that they have on hand the amount of ice required as per instructions mailed to them in advance of the date of shipment. The applicants are further urged to follow instructions carefully in the matter of avoiding delays in order that the work of aeration of the water may be lessened and to insure the fish arriving at the streams at the earliest possible moment and in the best condition. Attention is called to the fact that it is necessary to keep the fish protected from bright sunlight, when removing the covers of the cans for the purpose of aerating the water or inspecting the fish.

On reaching the waters to be stocked the temperature of the water should be equalized by placing a can of fish in the stream and then inclining the top of the can up stream thus allowing the water to flow gently into the can, or by pouring out a portion of the water from the can and filling it with water from the stream to equalize the temperature. Fish should always be planted in shallow, running water, avoiding pools, and should be well scattered.

In the past, in many instances, considerable numbers of fish have been planted by some of the applicants at one or two points on a stream. Far better results can be obtained by distributing the fish a can at each point along a considerable distance of the stream.

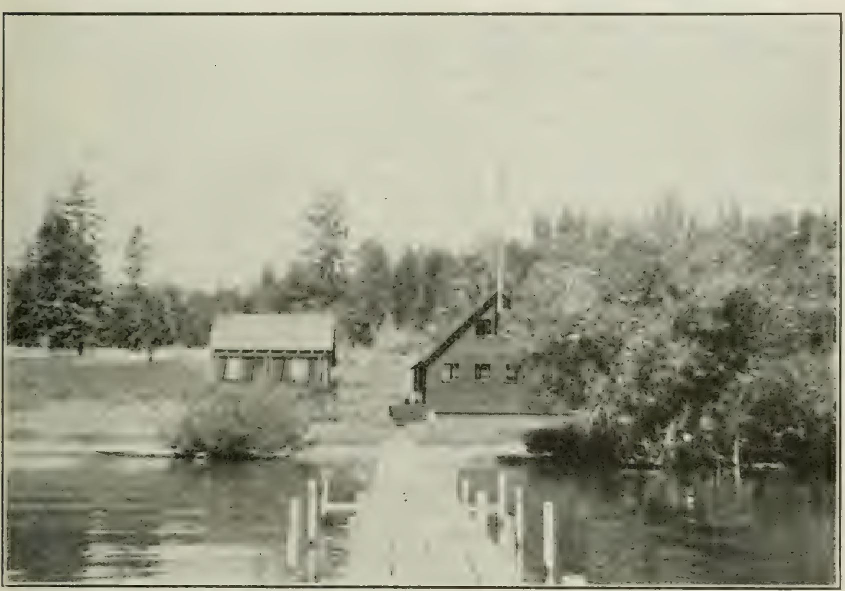

FIG. 36. The old Tahoe Hatchery, which will be abandoned when the new hatchery is completed.

In planting fish where it is necessary to carry the cans any distance from the wagon or auto truck, it is imperative that someone remain with the wagon and aerate the water in the remaining cans of fish during each planting. Also when stops are made for meals or other delays someone must be left with the fish to give the water the necessary aeration.

It is hoped that approximately 15,000,000 trout fry will be available for distribution, despite the unfavorable conditions for egg collecting operations this year, and if this number are properly planted, the streams will be provided with an adequate number of fry to insure fairly good fishing next season.

NOTES FROM THE STATE FISHERIES LABORATORY.*

Will F. Thompson, Editor.

THE "DAY" AND "NIGHT" SURF-FISHES OF NORTHERN CALIFORNIA.

It is very obvious that we know comparatively little about the fishes which inhabit the surf, or come there to spawn at the proper seasons. Notes regarding them are all of some value and usually will form valuable additions to our knowledge. The following are made from specimens received from Captain Tibbetts, of Eureka, to whom we are therefore considerably indebted.

In California Fish and Game for October, 1919 (Volume 5, No. 4), on page 203, Captain Tibbetts is quoted regarding two species of fish which are caught in the surf. One of these, known as the "night surf-fish," he believed to be the grunion, but upon our expressing some doubt regarding this, he sent us three specimens, taken a little south of Trinidad Harbor, on the ocean beach. They prove to be a species of the genus *Osmerus*, and its occurrence under the conditions noted is a fact well worthy of attention. What its habits are, and whether it spawns in the surf, is not known.

Captain Tibbetts was also kind enough to send us four specimens of the "day surf-fish." These, as we surmised in the article quoted above, belonged to the genus *Hypomesus*, which is caught in the surf along the California Coast north of Monterey.

THE GRUNION AT MONTEREY.

The spawning of the grunion is not known north of Long Beach, either to scientific men or to others. But, as Mr. Carl L. Hubbs has pointed out to us in a recent letter, the type specimen of the species was recorded as from San Francisco. Jordan and Hubbs in their review of the family *Atherinidæ* state that the original specimen came from San Francisco Bay, in which they supposed the species to live. However, this is improbable, when the life history of the species and its habits of spawning in the sand are considered. It is more likely that the fish was found in the markets, and came from some other locality on the open ocean close to San Francisco. A specimen of the grunion was found, on February 28 of this year, in the Monterey markets among fish taken locally in a seine.

In view of this proof of the presence of the species in these waters, high hopes were entertained that this remarkable species would be found spawning on the beach in northern waters, and attempts were made, in so far as circumstances permitted, to find them or their eggs.

On the night of March 6 Mr. Weymouth and Mr. Sette kept watch on the beach at Oceano, and found no sign of spawning fish, although the tide was the same approximately as that of the first run of the preceding year at Long Beach. Since the beach at Oceano is a splendid one, it was hoped that proof of their presence would be obtained there if any run occurred.

On April 6 a thorough search for eggs was made by Mr. Thompson, Mr. Sette and Miss Edwards along the beach between Del Monte and Seaside in Monterey Bay, but no signs of them were found, although if spawning had occurred to any extent during the preceding full moon tides, which were at their crest on the third of April, they would have been found. Again, on May 5, two nights after the full of the moon of May 3, Mr. Thompson and Mr. Weymouth patrolled the beach during the proper stages of the tide, but saw no signs of the fish themselves. In conjunction with the total lack of popular knowledge of a run, these attempts throw a certain amount of doubt on the occurrence of any extensive spawning run in these waters. It is of course still possible that a small run occurs somewhere near by, perhaps even on Del Monte Beach, or it may be that the specimens to be found here are simply strays. Further search will be made whenever opportunity offers.

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*California State Fisheries Laboratory, Contribution No. 19.

ENEMIES OF THE GRUNION AT LONG BEACH.

The normal run of grunion occurred at Long Beach on May 4, 5 and 6, and on the fourteenth Mr. Thompson and Mr. Higgins obtained large numbers of pods of eggs for the purpose of photographing the hatching when the eggs were in the proper stage. Greatly to their surprise, every third pod at least was badly infected with maggots, presumably those of the same fly whose maggots were found the preceding year but of which the species name was not determined. Even the pods set aside as clean were subsequently found to be infected, and it proved impossible to raise the eggs to the hatching stage without great injury. Not one in twenty-five of the eggs would hatch when the proper time came, although they were for the most part alive. As the normal percentage is near 100, this was a considerable disappointment to the photographer. The failure to hatch was undoubtedly due to the maggots, in conjunction with a very extensive infection by a small nematode worm which accompanied the maggots. The sand in which the eggs were was foul and ill smelling.

ALBACORE OFF SAN FRANCISCO IN DECEMBER.

Mr. H. B. Nidever, assistant in the San Pedro office, furnishes the following note regarding the albacore:

> F. G. Grotto, of San Pedro, who has fished for albacore here for several seasons, tells me that while he was making a trip on the "Daisy Mathiews," a lumber schooner from San Francisco to Honolulu, he caught two albacore trolling from the steamer about 280 miles out from San Francisco. He said that he saw two schools of fish and that those he caught weighed 18 to 20 pounds and that they had squid in their stomachs. The gonads of the fish were about one foot long and he could see developing eggs about the size of a pin head. They were caught on the eighteenth of December, 1919.

The reader who is interested might refer to a record of the taking of albacore off Northern California, on page 203 of the October number of CALIFORNIA FISH AND GAME for 1919. Such records are interesting as showing extremes of distribution.

OIL ON PISMO BEACH.

Professor Weymouth, engaged in studying Pismo clams for the Commission, reports that on the twenty-first and twenty-second of May, on the beach at Oceano and Pismo, a great many dead sea birds were observed covered with oil, and that many more still alive were lying on the beach with their feathers gummed with heavy oil. Dogs running on the beach chased and killed many of these. Ducks of various species and loons were observed among them. Professor Weymouth stated that he did not observe any clams dead from oil, probably because he was not on the beach at the right time.

The destruction caused among birds and mollusks by floating crude oil has been pointed out several times in these columns, and it is evident that the damage is still proceeding. An article by Professor Weymouth in regard to the destruction of mollusks appeared in CALIFORNIA FISH AND GAME, volume 5, No. 4, page 174.

CONSERVATION IN OTHER STATES.

NEW YORK DISPLAYS COLORED MOTION PICTURES.

Motion pictures in natural colors, showing the Adirondacks in summer and also at the height of their autumnal brilliancy, will form one of the special features of the New York Conservation Commission in carrying on its educational compaign. These natural colored motion pictures, taken during the past season, are the first of their kind ever taken in the Adirondacks, and were produced by an entirely new process.

HEAVY PENALTIES FOR HUNTERS IN MICHIGAN.

Five hundred dollars, the maximum fine, recently was levied by a judge in Michigan against a hunter for selling 32 ducks in violation of the Migratory Bird Treaty Act. Another violator of the same law, in Connecticut, who has been guilty of repeated offenses, was sentenced recently to three months in jail. This offender was not given the alternative of paying a fine. The Migratory Bird Treaty Act has been in force since July, 1918, and several hundred convictions have been secured. These cases are cited by the Biological Survey, United States Department of Agriculture, which administers the law, to show the increasing concern with which the courts regard violations of this important statute, designed to protect migratory birds, insectivorous birds and nongame birds.

COOPERATIVE INTEREST BETWEEN STATES.

The NewYork Zoological Society offered a reward of $200 for the arrest and conviction of any one killing antelope. On December 11, 1919, the following resolution was passed:

> *Resolved*, that the chairman be directed to notify Mr. Willian L. Finley, State Biologist of Oregon, that the New York Zoological Society hereby authorizes and will pay a reward of $200 for information leading to the arrest and conviction of any one killing wild antelope in the State of Oregon, upon the condition that the Oregon Fish and Game Commission give publicity and post notices to the above effect, and the treasurer of the society is hereby authorized to pay from the funds of the society the stated reward upon satisfactory evidence of such conviction.

The payment of this reward has been authorized and a check for $100 has been sent to Mr. George Tonkin, U. S. Game Warden, box 1531, Boise, Idaho, and a check for $100 has also been sent to Sheriff E. E. Woodcock, Lakeview, Oregon.

The Boone and Crockett Club are about to pass a similar resolution, which will apply to future convictions only.

WATER POLLUTION IN OHIO.

For ten years the water pollution problem was ineffectually dealt with in Ohio. Between 1909-1919 the responsibility of the yearly increasing urgency for action was passed from one department to the other—Health, Fish and Game and the State Chemists. The chemists accumulated much analytical information but they seemed to have found no remedy. In 1919 Mr. A. C. Baxter, Chief of the Ohio department, Mr. J. W. Stuber and Mr. J. T. Travers, Supervisor Stream Pollution, Ohio Department of Agriculture, took hold of the question and now, after having conducted experiments for over a year, Mr. Travers and Mr. E. J. Lewis, a water expert and chemist of Bellaire, Ohio, are ready to demonstrate the satisfactory results of their experimentation.

The process is the treatment of the pollution in vats as it leaves the factory or mine with a chemical having a lime base. This chemical precipitates or controls any organic pollution held in suspension in the vats, and also releases any poisonous gases.

The cost of the treatment is from 2 to 3 cents per thousand gallons, depending on the nature of the pollution, and the cost of installation is about $1,000. It is claimed that the by-products will often more than pay for the cost of installation and operation. The character and amount of polluted matter which is emptied into the Ohio streams daily is as follows:

Steel Mills—Sulphuric acid, three per cent solution. Six thousand gallons per day as an average from each factory polluting streams.

Straw Board Works—Organic matter which generates poison gases that displace the oxygen in the water and causes a sickening stench. Average of 800,000 gallons every 24 hours emptied into adjacent streams at each plant.

Sugar-beet Factories—Deadly organic matter which drives the oxygen from the water and kills every living thing in it. An average of 3,000,000 gallons every 24 hours from each sugar-beet factory in the state that uses a stream as a sewer.

Canning Factories, Cheese Factories and Casein Factories—Deadly organic pollution. Two thousand gallons per day from each factory that empties pollution into a waterway or stream.

Coal Mines—Copperas water containing from 300 to 500 grains per gallon of ferrous sulphate, deadly to aquatic life of all kinds and strong enough to eat up a steel rail in ten days. From 10,000 to 50,000 gallons per day, each mine.

The problem of stream pollution to all State Fish and Game Commissions is one of vital importance because of the exterminating effect of pollution on all forms of aquatic life.

The manufacturers throughout the State of Ohio are planning to install the system as soon as possible and the opportunity will be open to the other states of the Union to profit by this most valuable discovery.

GAME LAWS IN MASSACHUSETTS.

The game law of Massachusetts makes an open season on deer in that state from sunrise on the first Monday of December to sunset the following Saturday, the bag limit being one deer in a season, and it to be killed with a shotgun. There is no open season in Massachusetts on ruffed grouse, but quail and pheasants may be hunted legally each year from October 20 to November 20. The bag limit on quail is four in one day, or twenty during the season, and on pheasants two in a day, or six in a season.

American Field.

GAME LAWS IN COLORADO.

In Colorado there is no open season on elk, mountain sheep, antelope or beaver, but one is permitted to kill one deer having two or more points on each horn, from October 1 to October 4, both dates inclusive. Aliens are not permitted to hunt in the state or to own or possess firearms. Shipment of game out of or into the state is permissible, providing the shipper has a transportation permit issued by the State Game Commissioner, but not otherwise.

American Field.

LIFE HISTORY NOTES.

A CALIFORNIA CONDOR SEEN NEAR HEAD OF DEER CREEK.

On May 11, 1920, while inspecting a timber sale area at the head of Deer Creek, east of Hot Springs, California, in the Sequoia National Forest, with Supervisors Cunningham and Benedict and Deputy Supervisor Derby, we noted an immense bird circling over the clump of redwoods (*Sequoia gigantea*) on Deer Creek. The bird settled in the top of one of these trees 400 to 500 yards away from us. In flight it was like a buzzard, except that it was entirely too large. It had a brownish beak, a ruff around its neck, a light brownish color on the under feathers of its wings, and it had a very large wing spread. It appeared to be an adult specimen, the white tipped wing coverts and lanceolate feathers about the neck being particularly noticeable. We judged at the time that it must be a specimen of the California condor (*Gymnogyps californicus*), and in looking up the subject on our return to Hot Springs the description for that bird fitted very well the bird we had seen.

PAUL G. REDINGTON.

DUCKS IN THE IMPERIAL VALLEY.

During December ducks were fairly numerous in the Salton Sea at the mouth of the Alamo River, in Imperial County, but they were very difficult to approach and very few sportsmen were able to secure more than five or six birds at a time. A preponderance of shovellers was in evidence. Even with an abundance of ducks good shooting is limited in the Imperial Valley, owing to a lack of suitable shooting ponds. Apparently the best bags are obtained at certain seasons of the year when a high wind is blowing. At such times canvasbacks and "bluebills" are secured along their lines of flight.

UNITED STATES FOREST SERVICE COOPERATION.

STEELHEAD TROUT IN THE CALIFORNIA NATIONAL FOREST.

There are a number of streams in the California National Forest well stocked with fish. Those on the east side, flowing into the Sacramento River, are stocked with rainbow trout; and on the west side, the streams tributary to Eel River, with steelhead trout. A few other varieties, such as Loch Leven, eastern brook and black-spotted trout, have been introduced into the east side streams. It is commonly believed that steelhead trout, after attaining a length of 7 or 8 inches, migrate to the ocean, returning after maturity, being usually from 24 to 40 inches in length and weighing from 5 to 15 pounds. These large steelheads have been coming up the various branches of Eel River only, probably for all time; but until recently they were practically exterminated every year by Indian fishermen. There is one stream on the forest, the north fork of the Middle Fork of Eel River, which has many large, deep holes in which these fish stay all summer if unmolested, and as they readily take a hook they furnish splendid sport. Until the past few years the Indians have systematically netted and blasted these holes until they got every fish. We have been making a determined effort to stop this practice, with some results. During the past season two Indians were caught in the act of using illegal nets, one of whom plead guilty to the charge and a fine of $100 was imposed on him.

DEER SEASON TOO EARLY ON THE EL DORADO FOREST.

The open season on deer in Fish and Game District 1–I is believed by local forest officers to be entirely too early. It had far better be reduced to one month, from September 15 to October 15, than as it is at present. August 15 to September 15 is a very hot period, and many of the deer killed, or large parts thereof, spoil and are unfit for use.

In quite a few of the streams on the north side the fish (trout being the only game species) are pretty well depleted since up to last year little or no replenishing was done. Many of the lakes never have had any in them. At the proper time considerable cooperation can be gotten from interested parties, and the Forest Service should plan to be in position, financially, to help out.

MULE DEER ON THE LASSEN FOREST.

Big game, as it goes in California, is to be found on the Lassen in abundance. The mule deer (*Odocoileus hemionus*) is plentiful in the northeastern part and appear to be on the increase. They winter in the lava beds of Lassen and Modoc counties, and follow the snow to the higher areas in the spring. The bucks do not run with the does during the summer. Both, however, stay at comparatively low elevations until the middle of the summer when the bucks go to the high ridges. They will stay on the summer range until there is considerable snow before moving to the lower elevations. All move out together over well defined trails. The rutting season is November and December and the fawns are born in May and June. They usually are in pairs, one buck and one doe. The game refuge 1–F has been posted and we do not believe that there was any hunting within this area this season. It is well situated and should be a material factor for the increase of the species in its locality. There is considerable controversy as to whether or not the mule deer and Columbia blacktail deer cross. On certain ridges and mountains mule deer but no blacktail deer will be found, while on others blacktail only are found. However, several deer have been killed on the Lassen within the past two or three years that are apparently crosses, having the tail of the Columbia blacktail with no patch of white around the base of the tail, but having all other appearances of the mule deer. One of these is reported to have weighed one hundred and eighty pounds.

The only other species of deer known to be indigenous is the Columbia blacktail. This species is found in every part of the forest but less often in the country where the mule deer abounds. This deer winters in the foothills of the valley and moves to the higher areas as the snow goes off. During the spring and summer the bucks are to be found on the high rough ridges and the does and fawns on the meadows and flats. Bucks are often seen at the timber line on Brokeoff Mountain and Lassen Peak at an altitude of approximately 9500 feet. At the time of the first snows both bucks and does begin to move to the foothills. Ordinarily they all follow one or two routes. One of the best known of these is down the ridge between Deer and Mill creeks, just north of game refuge 1–G. The last few days of the season dozens of hunters congregate in that area and slaughter the deer as they move out. We are not prepared to make a definite recommendation at this time but it seems that it would be advisable to extend the refuge to include this area. Another well defined deer trail is the ridge between Mill Creek and Battle Creek at Mineral. There are a number of hunters here late in the season too but apparently not enough to warrant the creation of a game refuge. The winter range is the foothills below pine timber. The summer feed is largely browse with a little grass and with acorns. Rutting season is from November 1 to December 15 and the young are born from May 1 to July 1. As a rule, the fawns are in pairs, one doe and one buck. The bucks shed their horns from February 15 to April 1. Deer were fairly plentiful last year, but apparently have decreased 5 per cent in the past twenty years. The area in game refuge 1–G is well adapted for the purpose intended but we are advised that game violations are frequent. Owing to the remoteness of the area from the center of the forest and the press of other work forest officers are unable to give the refuge the protection that it should have. If wardens could be appointed for the area much better results would be secured. During the winter, when the state game wardens are known to be in the rice fields, game trespassers are said to be numerous in the foothills. Very probably an occasional trip by the state game wardens would lessen this form of game violation 50 per cent.

The Lassen offers some of the best trout fishing in California. The rainbow are indigenous to practically all of the streams. In past years rainbow, eastern brook, Lock Leven and black-spotted fry have been planted. Of these the eastern brook and rainbow have done the best. No record has been kept of the relative number of each species planted but it is found that in the streams planted the rainbow have done the best in the deeply shaded canyons while the eastern brook, black-spotted and Lock Leven have done better in the open stream as it flows through meadows. In Battle Creek at Mineral a catch will average 60 per cent eastern brook, 5 per cent Lock Leven, 10 per cent black-spotted and 25 per cent rainbow in the meadow and will run 90 per cent rainbow in the canyon less than a mile away. The part of the stream through the meadow has been more heavily planted than has the part of the stream in the canyon. Several of the small lakes within the forest have been planted. Steelhead were planted in Juniper and Grassy lakes in the summer of 1914. Two and three pound fish were taken from this lake in 1918 and some reported to weigh ten pounds in 1919. There has been considerable discussion as to whether these fish will spawn in the lake as it has no streams running into or from it. Some have contended that as the fish are unable to spawn in their usual habits they will die and that within a few years the lake shore will be covered with dead fish. This has not occurred as yet. The trout planted in most of the streams have remained quite small. The California Fish and Game Commission have established a hatchery and egg taking station within the forest at Domingo Springs on the Feather River and are planning another one on Warner Creek. Both of these streams have a big run of rainbow at spawning time and afford excellent fishing. Steelhead and salmon run up both Deer and Battle creeks from the Sacramento River at spawning time. In both streams there is a high falls that keeps them from reaching the headwaters. However, it might be advantageous to blast out these falls. During the early eruptions of Mount Lassen and the subsequent flood all of the trout in Hat Creek were either washed away or killed. For the past several years there have been practically no fish in the creek. The stream is now becoming clearer, however, and the fish are beginning to appear again. The waters of this stream are largely used for irrigation and the residents prefer not to have the stream stocked so that they will not be compelled to put in fish screens.

REPORTS.

CALIFORNIA FRESH FISHERY PRODUCTS, JANUARY, FEBRUARY AND MARCH, 1920.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
Albacore												3,325				3,325	
Anchovies								225		19,391		4,572				24,188	
Barracuda								61	221		39,378	254,759		136,241		430,660	1,740,664
Bluefish									107	16,501						16,608	
Boccaccio	334							85,755	157,025	272,434						515,548	
Bonito											1,368	56,630	2,452	18,210		78,660	139,090
Carp				2,297	49,895		21,097	224					5,230			78,743	
Catfish	97	16,244		4,645	13,025											34,011	
Chilipepper								56,278	73,607	3,101						132,986	
Cultus cod	291		31				864	156,205	31,473	68,933	365					258,162	
Flounders	3,961		255	3,682			818	131,796	13,775	42	800	1,469				156,598	
Grayfish			160				15	95,080		220	300	108,823		17,077		221,675	12,628
Greenfish												412				412	
Hake								10,700								10,700	
Halibut	1,350							14,062	9,905	351	52,070	541,058	75,062	287,476		981,334	352,393
Hardhead					10,951		55									11,006	
Herring	6,836		65,470				38,120	115,090								225,516	
Kingfish			8					1,108	16,566	15,811	33	153,963	161	2,502		190,152	
Mackerel										24,172	1,226	306,882	593	23,907		356,780	32,251
Mullet														11,525	4,496	16,021	
Perch	17,306		11,727	40			266	11,773	875	8,625	180	8,815	317	135		60,059	290
Pike				85	991		2,813									3,889	
Pompano								24		870		10,613		58		11,565	231
Rock bass											60	8,155	805	2,892		11,912	630
Rockfish	5,664		84					245,664	80,826	165,292	45,575	525,795	4,479	385,721		1,459,100	83,929
Sablefish								346,418	1,625	2,522						350,565	
Salmon	818		759	78,223	21,170	2,461	71,125	16,097	119	146,939						337,711	
Sanddab								207,775	7,006	476	25	2,198				217,480	

Sardines								614,316	1,385,900	21,472,739		24,537,871	378	7,642,187		55,683,391	3,185
Sculpin												4,714	65	989		5,768	
Sea bass (black)												11,025	110	14,994		26,129	27,218
Sea bass (white)								387	15	29	1,097	395,172	467	6,039		403,206	47,159
Sea trout	54											1,044		5,689		6,787	5,562
Shad				6.062	267		12,021	1,360								19,710	
Shad (buck)				15,035	1,529		22,731									39 295	
Shad (roe)				13,116	1,440		21,986									36 542	
Sheepshead											91	1,410		7,099		8,600	
Skates								39,660	1,625			1,737	73	65		43,160	
Skipjack														445		445	
Smelt	15,625	245	20,434				3,226	51,544	152	18,550	27,191	35,412	4,672	11,111		188,162	39
Sole	302			29				982,340	51,276	1,751	2,778	35,906	269	1,741		1,076,392	
Splittail					6,869		5,206									12,075	
Striped bass			2,334	59,769	10,298		82,100	29,706		17						184,224	
Stingaree																	24,885
Suckers					1,568											1,568	
Swordfish														21		21	
Tomcod							48	20,457								20,505	
Tuna												1,395				1,395	
Turbot			440					34								474	
Whitebait			68					34								68	
Whitefish												1,574		3,207		4,781	4,417
Yellowtail												258,195	125	18.582		276,902	68 838
Miscellaneous				14			35	12.556	1.258	3,850	61.927	1.538	287	2.900		84,365	630
Total fish	52,638	16.489	101,770	182,967	118,003	2.461	282,556	3,276,695	1,833,356	22.242.616	234,461	27,277.462	95,545	8,600,816	4.496	64.322,334	2,544,039
Crustaceans—																	
Crabs (doz.)	1,385		286				1	23,499	202	7						25,380	
Shrimps								182.725				171				182,896	
Spiny lobsters											7,649	61,902	7,160	11,140		87,851	316.956
Mollusks—																	
Abalones	225	10	475							31,449	11,291					43,450	29,959
Clams (cockle)	4,115		1,708								700		2,788			9,311	
Clams (mixed)	5,623		11,239				104	1,304					20			18,290	18,500
Clams (Pismo)									135		72.802					72,937	
Clams (softshell)	396	3,469	1,540				22,695	2,301								30,401	
Cuttlefish			64					5,093	3,375	23,895		351				32,778	
Limpets													535			535	
Mussels							2,289	360	1,000		292	577	1,663			6,181	

CALIFORNIA FRESH FISHERY PRODUCTS—Continued.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
Oysters, Eastern (number)			306,702					1,143,750								1,450,452	
Oysters, native			14,630													14,630	
Snails												280				280	
Squid	90									247,511		135,122				382,756	
Miscellaneous—																	
Turtles																	2,180
Scallops													513			513	

All amounts shown in pounds unless otherwise specified.

CORRECTION.—In the April issue of CALIFORNIA FISH AND GAME was shown a report of California fresh fishery products for the year 1919, and on page 94, amounts of sanddab and sardines shown for Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties were transposed. Amounts shown for Marin, San Francisco and San Mateo counties were correct. Below is shown the correct amounts of sanddab and sardine taken in California during 1919.

District	Sanddab	Sardine
Marin		441,700
San Francisco and San Mateo	628,206	1,362,518
Santa Cruz	67,885	5,141,869
Monterey	2,602	81,147,280
San Luis Obispo, Santa Barbara and Ventura	1,394	54
Los Angeles	7,830	54,600,194
Orange		25
San Diego	1,821	11,183,539
Totals	709,738	153,877,179

VIOLATIONS OF FISH AND GAME LAWS.

January 1 to March 31, 1920.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	24	$420 00
Trapping without license	5	45 00
Trapping on game refuge	1	100 00
Deer—close season—killing or possession	9	540 00
Female deer—spike bucks—fawns—killing or possession	2	100 00
Running deer with dogs—close season	2	50 00
Illegal deer hides—possession	2	90 00
Beaver—beaver hides—killing or possession	2	125 00
Quail—closed season—killing or possession	3	75 00
Quail in captivity without permit	1	10 00
Ducks—excess daily limit—close season—killing or possession	9	625 00
Shooting ducks from power boat in motion	8	120 00
Night shooting	17	625 00
Doves—close season—killing or possession	1	5 00
Swan—killing or possesion	4	175 00
Pheasant—killing or possession	1	20 00
Protected shore birds—killing or possession	4	85 00
Nongame birds—killing or possession	5	55 00
Tree squirrels—closed season—killing or possession	4	75 00
Total game violations	104	$3,340 00
Fish.		
Angling without license	10	$235 00
Fishing for profit without license	6	125 00
Making false statement on application	1	25 00
Striped bass—underweight—close season	4	45 00
Halibut—underweight—offering for sale	7	155 00
Barracuda—underweight—offering for sale	1	----------
Trout—excess limit—offering for sale—closed season	8	250 00
Lobsters, dried—under or oversized—closed season	15	321 00
Crabs—undersized—closed season	4	40 00
Abalones—red, black and green—under or oversized	33	670 00
Clams—undersized—excess limit	11	260 00
Dynamiting fish	2	----------
Seining in restricted waters	3	600 00
Seining within 750 feet of Redondo Pier	6	650 00
*Seining within one mile of Los Angeles city sewer	3	300 00
Pollution of state waters	1	200 00
Total fish violations	115	$3,876 00
Grand total fish and game violations	219	$7,216 00

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*Paid into Los Angeles County treasury.

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS.

January 1, 1920, to March 31, 1920.

Game.	
Deer meat	298 pounds
Ducks	780
Gray geese	17
Rabbits	70
Live quail	6
Miscellaneous birds	4
Deer hides	13

Fish.	
Halibut	2,638 pounds
Barracuda	200 pounds
Striped bass	574 pounds
Catfish	50 pounds
Trout	65
Crabs	1,143
Lobsters	955
Lobsters (dried)	131 pounds
Abalones	609 pounds
Pismo clams	566
Cockle clams	1,275 pounds
Little Neck clams	220 pounds
Illegal nets	5
Searches.	
Illegal fish and game	3

Fish and Game Commission

STATEMENT OF EXPENDITURES.

For the Period July 1, 1919, to April 30, 1920.

Administration:		
Commissioners	$1,400 84	
Executive offices	22,031 42	
Research and publicity	4,188 23	
Accident and death claims	1,902 31	
		$32,979 32
Commercial fish culture and conservation:		
Superintendence	$11,105 57	
Inspection and patrol	25,051 65	
Research	15,055 76	
Statistics	8,153 41	
Market fishing license commissions	695 00	
Propagation and distribution of salmon	19,498 83	
		79,560 22
Sporting fish culture and conservation:		
Superintendence	$12,102 31	
Printing	1,864 69	
Prosecutions and allowances	404 55	
Angling license commissions	11,765 70	
Special field investigation	252 35	
Fish exhibits	7,208 91	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	28,780 33	
Los Angeles District (40 per cent)	11.540 18	
Sacramento District (40 per cent)	22,826 26	
Propagation and distribution of trout	101,218 84	
		197,964 12
Game conservation:		
Printing	$2,746 76	
Prosecutions and allowances	1,180 00	
Hunting license commissions	17,952 90	
Mountain lion hunting (and bounties)	6,062 48	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	43,161 57	
Los Angeles District (60 per cent)	17,310 30	
Sacramento District (60 per cent)	34,404 45	
		122.819 06
Tahoe camping ground		2,964 39
Total expenditures		$436,287 11

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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DISTRIBUTION OF THE GOLDEN TROUT IN CALIFORNIA.

By S. L. N. Ellis and H. C. Bryant.

Fishermen and nature lovers who frequent the wild, rugged climes of the southern Sierra are now, most of them, familiar with the golden trout, *Salmo roosevelti.* This fish is known to excel any other species of trout in beauty, not only because of its well-proportioned form, but more particularly because of its exceptionally brilliant and rich coloration.

There are three recognized species of golden trout: the Little Kern golden trout, *Salmo whitei*; South Fork of the Kern golden trout, *Salmo agua-bonita,* and Roosevelt trout, of Volcano Creek, *Salmo roosevelti.* The Kern trout, *Salmo gilberti,* is the parent species from which the three, afore named, were probably derived; and, so far as is known, all four species are native to the head waters of the Kern River.

The distinctive characteristics of these diversified types is more readily appreciated if the geographical isolation of their habitat is understood. It has been stated that the Kern trout, *Salmo gilberti*, is the parent species of the golden trout, and as may be inferred from the name, is native to the Kern River. This river is of considerable width and flows through a most inspiring, deep, rugged, high Sierran canyon, and in ages past, when the glacial period wrought its stupendous changes, the Kern River trout, native then to not only the Kern River but to its tributory streams—Volcano Creek, South Fork of the Kern and the Little Kern and Soda Creek—became isolated in these different streams by the formation of unsurmountable barriers, and each group being acted upon by the influences of its own peculiar environment, with no opportunity for interbreeding of groups, resulted,

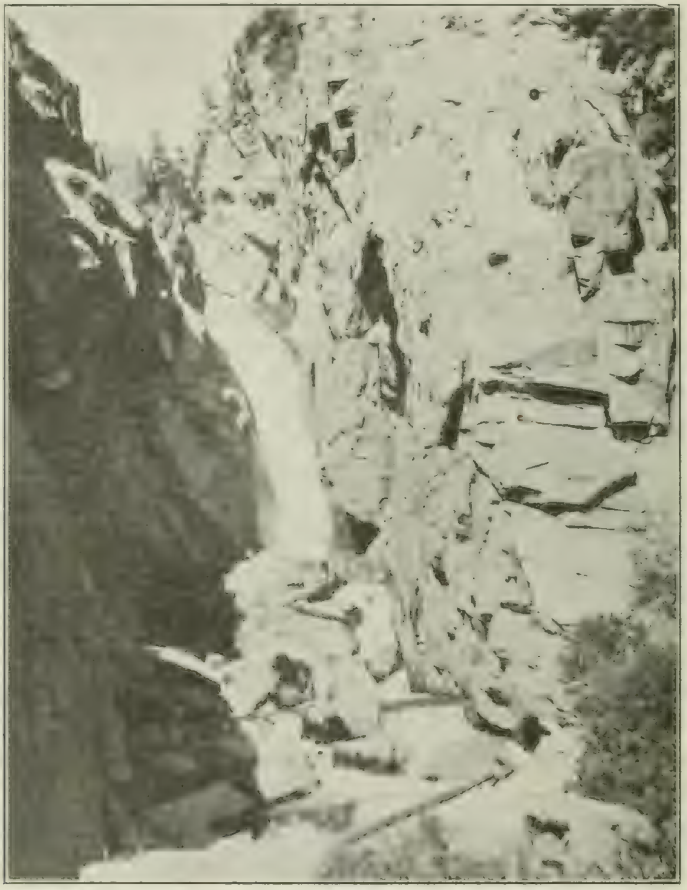

FIG. 37. Agua-bonita Falls on Volcano Creek, the stream which is the original home of the golden trout. Photograph by W. Y. Kellogg.

quite naturally, in each one developing in its own distinctive, characteristic way.* And the golden trout, *Salmo roosevelti*, of Volcano Creek, the most radiantly beautiful of them all, became the most individual.

But the changes which Volcano Creek underwent were far more enduring and much more complicated than the changes which occurred in the other streams, for aside from the impassable falls, formed by the wearing down of the stream beds, Volcano Creek, formerly called Whitney Creek, underwent volcanic changes of a more or less unique character, which accentuated the deepening characteristics of the stream, and in all probability temporarily cut it off entirely from the Kern River.

Volcano Creek rises south of Cirque Peak. Several small, clear, mountain streams, having their sources at an elevation of from 10,000 to 13,000 feet, thread their way through picturesque, grassy meadows to the point of confluence. For a distance of about eight miles the creek flows in somewhat of a southerly direction until it enters Toowa Valley, then it turns west in a widening course and joins the Kern River about opposite Soda Spring. The South Fork of the Kern River has its source near that of Volcano Creek and it enters Toowa Valley at about the same place, and in the days when this section of the southern high Sierra was first traversed by white men, the idea was conceived of joining Volcano Creek and the South Fork of the Kern by a tunnel. This was quite possible, for a small ridge less than a hundred yards wide, in parts, and scarcely fifty feet high divided the streams. No doubt at one time the South Fork of the Kern was a natural tributary of Volcano Creek. The tunnel which was made caved in, but in the course of experimentation some of the golden trout escaped into the South Fork. The cut filled up and the two streams again became entirely distinct. Above this tunnel, which is at an elevation of 8600 feet, Volcano Creek flows through meadowy country, the creek bottom being granite sand and gravel; but below the tunnel for a distance of eight miles or so, to the point where the creek enters the Kern River, and at a drop in elevation of 2300 feet, the stream bed is of volcanic character and the stream itself very turbulent. It is not, however, due to the rapids, but to the three falls—Agua-Bonita, with a small fall known as Surby Fall between it and Stewart Fall (second), and the third, Shields—that the trout are barred from traveling from one body of water to the other; and in fact, such natural barriers as these are the cause of fish isolation in the several streams, and of even entire lack of fish in some, where volcanic action and other forces were at play—the streams and lakes are barren, many of them despite a good supply of food.

The value of distributing the golden trout can hardly be overestimated. First, it has saved these beautiful fish from the complete extermination with which they were threatened. Secondly, the trout are being planted in heretofore barren streams and lakes, and therefore they will furnish added fishing grounds for the angler. Too, the fish, without the possibility for interbreeding, will remain the pure type. And third, they are a prolific fish, and, to the delight of all sportsmen, are extremely gamey.

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*"The Golden Trout of the Southern High Sierras," by Barton Warren Evermann, 1906. U. S. Bureau of Fisheries Bull. 25, pp. 3-51, 16 pls., 1 map.

The earliest record we have, of the transplanting of the golden trout to streams other than those of their natural hibitat, was in the year 1876. The two Stevens brothers, who had built a small sawmill on Cottonwood Creek, were anxious that the stream be well stocked with fish for their own use. They went over to Mulky Creek, in Mulky Meadows, and procured what in all probability were the *Salmo agua-bonita*, or South Fork golden trout, and planted them in Cottonwood Creek.

In the summer of 1876, Mr. S. L. N. Ellis says: "I was at Mineral King and Mr. Arthur Crowley, former assessor of Tulare County, showed me a single large trout in the creek at Mineral King. He told me that 'uncle' Wiley Watson had brought some trout from the Little Kern via Farewell Gap and had planted them in this stream." The first plant made by Watson reproduced rapidly and furnished the supply for the fishermen at Mineral King until 1894, when the later plants were made. Mr. Ellis caught fish at Mineral King in 1887, while he was out on a hunting and fishing trip in that region. This work was very important for it was the move which undoubtedly interested others in fish planting, and which caused others, later on, to try and accomplish similar plants.

After a lapse of some nine years, G. W. Cahoon contributed his share to the transplanting of the golden trout. Mr. Cahoon was a cattle rancher who during the summer carried butter by pack from the head of the South Fork of the Kaweah over the pass to Inyo County. On his way back he caught the golden trout, *Salmo whitei*, in Soda Creek at Quinn's Horse Camp and planted them in the South Fork of the Kaweah, at Evelyn Lake, where there were no fish.

In 1887, two years after Cahoon had made his plant of *Salmo whitei*, James McIntyre, a sheepman, procured some of the same species of trout at Rifle Creek and planted them in Coyote Creek, a tributary of the Kern.

Again there was a period of trout planting inactivity, but in 1892 Cottonwood Lakes were planted by E. H. Edwards and two friends. Edwards, who was a storekeeper at Lone Pine, desired to improve the fishing conditions in his vicinity, so with James Moffitt and B. H. Dutcher he obtained a catch of *Salmo agua-bonita,* the same variety which had been planted by the Stevens brothers in Cottonwood Creek in 1876, and planted them in Cottonwood Lakes. This plant was apparently very successful, for in 1906 Cottonwood Lakes were reported by the storekeeper of Lone Pine as being unusually well stocked with golden trout.

The year 1892 is especially memorable in the history of the planting of the golden trout in that it was during this season that the first hatchery propagation of the species was undertaken. Too, it was during this year that they were first exhibited to the public. Members of the Visalia Sportsmen's Club had long been desirous that the propagation of this splendid game fish be undertaken, and it was through the interests and efforts of the club that S. L. N. Ellis, equipped with four coal oil cans fitted with baking powder can lids, made a trip to Volcano Creek and procured about a hundred of the fish. These he carried to Lower Funston Meadows. At Funston Meadows he met Lieutenant Deane with a detachment of soldiers patrolling the

Sequoia National Park. Lieutenant Deane detailed two of his men, Sergeant Moffitt and Private Scholberg, to take the fish to Mineral King. There the party was met by J. Sub Johnson and M. L. Weaver, who were members of the club and residents of Visalia. These two men took the fish in a spring wagon to Visalia, and from there they were shipped by train to San Francisco and were delivered to the Fish and Game Commission. The plan was to send the fish to the hatchery at Sisson. However, before the trout were sent on the last lap of their journey, they were exhibited not only at the Midwinter Fair but at Golcher Brothers store in San Francisco. Thirty-six fine specimens were finally shipped to the Sisson hatchery, twenty-one reaching their destination in good condition, but the experiment was not considered satisfactory.

In 1896, the first plant of the true golden trout, *Salmo roosevelti*, was made. All previous plantings had been either of the *Salmo aguabonita* or *Salmo whitei* variety. During the summer of this year Mr. S. L. N. Ellis, accompanied by his son, L. L. Ellis, and a friend, F. J. Hill, planted the North Fork of the Kaweah—known as Dorst Creek—with fish taken from Volcano Creek, the original home of *Salmo roosevelti*. In the same season, Mr. Ellis in attempting to carry some of the fish from Volcano Creek to the North Fork of Kaweah, found that the trout were not standing the trip well and so decided to plant some of them in the Kaweah near Mineral King, and about twenty-five others, which were sick, in Silliman Creek and Willow Meadow. Nothing was ever heard of the latter plants. When in Mineral King, Mr. Ellis met the artist, Petrie, and showed him the golden trout, which were the first that the painter had seen. He was so charmed by their rare beauty that he soon afterwards used the fish as the subject for a painting.

The following year an unsuccessful plant of the golden trout was made by Mr. J. M. Nelson, in Nelson Creek, a tributary of the Tule River. Also some cattle men carried fish from Whitney Meadows and planted them in Rock Creek. Another plant of trout was made in Rock Creek in August, 1900, by Mr. M. W. Buffington, county surveyor of Kern County. He wrote Major George W. Stewart of Visalia that he and a party of other men carried the trout in small lard cans—about seven in each can—to Rock Creek and turned some of them loose; the rest they carried to the trail crossing and placed them there.

From 1897 to 1908 no authentic information regarding the planting of golden trout seems to be available, and that regarding the seasons of 1897 and 1900 seems to be rather incomplete. However, it was at this time that the government became actively interested in the protection of the golden trout. In 1903, according to Dr. Barton W. Evermann, Stewart Edward White, impressed with the possibility of the extermination of these trout, wrote to George M. Bowers of the Commission of Fisheries and to the President of the United States calling their attention to the matter, and on July 13, 1904, Barton Warren Evermann, Assistant in charge of the Division of Scientific Inquiry, Bureau of Fisheries, with a party outfitted at Redstone Park, Tulare County, left for the Whitney country to investigate the trout of the Kern River region. As a result of the investigation, the true golden trout of Volcano Creek was recognized as a new species, and was named after the naturalist, Theodore Roosevelt, who at that time was president of the United States.

The United States Bureau of Fisheries made an extended study of the trout, and in 1905 an attempt was made to establish a temporary hatchery station on Volcano Creek in order that the eggs of the golden trout might be obtained. But the spawning season was over before operations could be started. Two hundred and sixty-four trout were taken during the season to the Lewis and Clark Exposition at Portland, but as the result of an accident the entire lot was lost. Aside from the year-round, closed seasons for the golden trout adopted at a later date, the general program suggested was as follows: (1) The catch of golden trout should be limited to less than the number allowed for other trout. (2) Fish culture should be promoted, and (3) the limits of the Whitney Military Reservation should be extended to include the whole of Volcano Creek.

That the fish is a hardy fish seems to have been rather well demonstrated in 1906. In March of that year the Fish and Game Commission undertook to collect some specimens of the fish for exhibition purposes at the "Forest, Fish and Game Exhibit," held in San Francisco. About fifty specimens of the trout, *Salmo agua-bonita* were taken from Cottonwood Creek, a stream the temperature of which is about 38°, and were transferred to water which was about 60° in temperature. They lived in their new environment for some two weeks or more. But at the end of the exhibition period, when the fish were sent to the Sisson Hatchery, about three-fourths of them died, evidently due to the added travel and the more or less depleted condition of the fish. Another instance of their adaptability and hardiness was reported by A. D. Ferguson. In 1913, he investigated a plant made by Deputy Bullard, in 1911. Bullard had stocked a small creek at Traweeks, in Fresno County, with golden trout. The stream is at an elevation of 3500 feet and the temperature during the summer months reaches about 75°. Mr. Ferguson says, "I found golden trout of various sizes in considerable numbers in this creek. A specimen some twelve inches in length, I judged to be one of the original plant."

In 1908 the Sierra Club did some splendid work. The club in making their plants used two ten-gallon Buhl cans with airholes in the covers. On July 7, they caught 110 trout with hook and line, the trout ranging in length from four to six inches. They were secured at the head of Long Meadow on Volcano Creek and were packed for about three hours to a lake in Rocky Basin. Only one fish was found to be dead and that was due to the way in which it had been hooked. On July 15, the head Sierra Club packer, Mr. J. Robinson, and his family caught 54 trout in Rock Creek averaging from 10 to 12 inches in length. They had undoubtedly been planted in the creek several years before. These were taken to a lake at the head of one of the branches of Rock Creek. The third plant, made under the supervision of Mr. Wm. E. Colby, Deputy Fish Commissioner, was of 50 trout from the above named creek. They were planted in Whitney Creek.

According to Mr. A. H. Hogue, forest supervisor of the Inyo National Forest, 600 golden trout from Little Whitney or Long Meadows were taken to Gardner Creek during the same season.

It was in the year 1909 that the Fish and Game Commission first took charge of the planting of the golden trout. Previous to this time the work had been done by sportsmen or clubs at their own expense. After the Commission took hold of the work, improved pack cans were provided and the loss of the fish in transportation was much reduced. The work of distributing the golden trout on the east slope of the Divide was carried on by Deputy E. H. Ober, who in the face of many difficulties successfully transferred 1500 trout, ranging in size from two to seven inches, to Independence, over the Hockett trail. There the outfit was divided, half went over to Kearsarge Pass via Lake Charlotte to Gardner Creek and Gardner Lakes, and the other half went to Grouse Meadows on the head waters of the Middle Fork of the Kings River, via Bishop and South Lake on Bishop Creek. The fish for this plant were obtained by diverting the creek at Long Meadows from its course.

District Deputy A. D. Ferguson of Fresno, assisted by Deputy S. L. N. Ellis in the field, directed the work in the Kern River, Kings and Kaweah basins, on the western slope. Mr. Ellis says in regard to his experience:

"On my return trip from Whitney Meadows, I brought back three mule loads of golden trout for planting in Roaring River and nearby streams with scarcely any loss. This was partly due to improved pack cans, but more especially to the fact that I had learned that the fish can not stand too long a trip. Prior to this time I had made eleven or twelve hours a day and had lost as many as 75 per cent of my fish. On this trip I learned from observation that by making short trips—say of five or six hours a day—a much greater percentage of the fish could be saved. Up to seven hours the fish can keep away from the sides of the cans, even though the trail may be very rough, but after this time they become exhausted and are bruised by striking against the sides of the containers. During the stops made, the cans were set in a creek and fresh water allowed to flow over them. Prior to this time my idea had been to hurry the fish to their destination as quickly as possible."

The following year Mr. Ellis' party took 183 adult *Salmo roosevelti* caught with a seine at Whitney Meadows and planted them in the watershed drained by the tributaries flowing in to Roaring River. They lost only six of the trout although they travelled for six days over 100 miles of extremely rough country. Mr. Ober and his assistants, Sam McMurray and George Hall, in the same year covered about 115 miles and stocked Center Basin and Bench Lake as well as the head waters of the South Fork of the Kings. This made the total plant for July and August, 1910, more than 1800 large golden trout distributed among twenty-three lakes and streams in which no fish had previously existed, but which were rich in fish food. In a recent letter Mr. Ober says, "I felt that the waters I had selected would be ideal for fish, and my judgment seems to have been good, for in 1918 I took two golden trout out of Bench Lake that weighed three pounds each."

The following summer Mr. Ellis and Mr. Ferguson, with a group of friends and assistants, secured over 1300 *Salmo roosevelti*, by changing the course of the stream at Little Whitney Meadows and by hook and line. Ferguson at this time procured twelve or thirteen *Salmo agua-bonita* golden trout from Cottonwood Lakes and Creek. All of the trout were delivered to the Fish and Game Commission's fish car at Lone Pine and were shipped to the Sisson Hatchery. A few of the *Salmo agua-bonita* were exhibited in Sacramento. Deputy Bullard, who had helped with the pack, took, in the course of the return trip, a hundred trout from Volcano Creek, which he planted in the North Fork of the Kaweah, Indian Basin and Traweek Creek.

These who visited this great wonderland of the southern Sierra Nevada began to find not only the ordinarily beautiful trout, but in previously uninhabited streams they saw darting forms of gold and silver, and the fishermen rejoiced. However, in order that the pleasure of golden trout fishing might be better assured to the ever-increasing numbers of fishermen, the law which is incorporated in the penal code is as follows:

"633. Every person who, at any time between the first day of October and the thirtieth day of June of the succeeding year, takes, catches, kills, destroys, or has in his possession, any variety of golden trout; or who, at any time, takes, catches, kills, or destroys, any variety of golden trout other than with hook or line; or who, at any time, takes, catches, kills, destroys, or has in his possession, during one calendar day, more than twenty golden trout, or has in his possession any variety of golden trout of less than five inches in length, is guilty of a misdemeanor. Every person found guilty of any violation of any of the provisions of this section must be fined in a sum not less than twenty dollars or be imprisoned in the county jail, in the county in which the conviction shall be had, not less than ten days, or be punished by both such fine and imprisonment, and all fines collected for any violation of any of the provisions of this section must be paid into the state treasury to the credit of the fish commission fund. Nothing in this section shall prohibit the Fish Commission of this state from taking at all times such golden trout as they deem necessary for the purpose of propagation or for scientific purposes."

In 1912 the packhorse distribution work was confined to Madera and Tuolumne counties, so that it was not until 1913 that Deputies Ellis and Smalley, with a splendidly equipped pack train, proceeded with the program for the transplanting of the golden trout. On September 1, Ellis and Smalley left Whitney Meadows with 821 *Salmo roosevelti* to plant Roaring River and tributaries. It had been an unusually rainy season in the mountains, and all during their previous golden trout plants they had been handicapped by finding trails obstructed and streams swollen. The fish, too, were difficult to catch. But undaunted they left Whitney Meadows with the 821 trout, descended the Kern River Canyon, crossed the Kern-Kaweah Divide to Mineral King, ascended Timber Gap, descended again to the Kaweah Canyon, and on over the Kings-Kaweah Divide via Elizabeth Pass to Roaring River. Some of the trout had been in the cans fourteen days, yet despite the hard travel and circuitous route only five trout were lost. At the close of the season 87 plants had been made of the species and with no exception the species used by the Commission in the golden trout plants had been the *Salmo roosevelti*.

About 5000 adult golden trout, *Salmo roosevelti*, were taken with hook and line in 1914, and were transplanted to barren waters. Thus the range of the trout was extended for more than 150 miles along the summit of the Sierra from Volcano Creek.

FIG. 38. Spawning golden trout at Cottonwood Lakes. Photographed by N. M. Scofield.

One thousand nine hundred seventeen marked a new step in the distribution of the golden trout. In that year it was decided to undertake the propagation of the golden trout. Cottonwood Lake, though situated in an inaccessible part of Inyo County, was decided upon for the spawning station, and despite the difficulties which had to be surmounted 500,000 eggs were taken and were successfully transported by pack animal to the new Mount Whitney Hatchery. At the hatchery they were "eyed" and afterwards were distributed in the waters of that section. It is from the Mount Whitney Hatchery that the more recent plants have been made, and Mr. Ober reports that during September and October of 1919, he made plants of the trout in two beautiful lakes at the head of Woods Creek, Little Pine Creek and South Fork Lake on Big Pine Creek. Several plants have also been made in Yosemite National Park.

Thus it is that through long endeavor and splendid cooperation this marvelously beautiful golden trout, a fish that appeals to every sportsman, has been protected, and distributed in one of the most inspiring sections of the Sierra Nevada Mountains.

TABLE SHOWING PLANTS OF GOLDEN TROUT.

Date planted	Lake or stream	By whom planted	Source of supply	Species
1876	Cottonwood Creek	A. C. Stevens, S. V. Stevens and Thos. George.	Mulky Creek in Mulky Meadows	*Salmo agua-bonita*
1876 or 1875	East Fork of the Kaweah at Mineral King.	Wiley Watson and others	Upper Little Kern	*Salmo whitei*
Late 70's	Lady Franklin Lake	Arthur Crowley, W. A. Ward, Wiley Watson.	Little Kern, "over the divide"	*Salmo whitei*
1880	Upper and Lower Monarch Lake and Mineral King Creek.	Mark Lavelle and "Nick" Wren	Little Kern, "over the divide," or Farewell Gap.	*Salmo whitei*
1885	Head of South Fork of the Kaweah near Evelyn Lake.	G. W. Cahoon	Soda Creek at Quinn's Horse Camp	*Salmo whitei*
1887	Coyote Creek (tributary to Big Kern)	Jas. McIntyre	Rifle Creek	*Salmo whitei*
1892	Cottonwood Lakes	E. H. Edwards, Jas. Moffitt, B. H. Dutcher.	Cottonwood Creek	*Salmo agua-bonita*
1892	Wet Meadows (head of South Fork of Kaweah).	G. W. Cahoon	Little Kern	*Salmo whitei*
1892	Exhibited in San Francisco; taken to Sisson Hatchery.	Caught by S. L. N. Ellis; delivered at Lower Funston Meadows to Sergeant Moffitt and Private Scholberg; Mineral King, M. L. Weaver and J. Sub Johnson.	Volcano Creek, above bridge	*Salmo roosevelti*
1896	North Fork of the Kaweah (known as Dorst Creek).	S. L. N. Ellis, L. L. Ellis and F. J. Hill	Volcano Creek	*Salmo roosevelti*
1896	Marble Fork of the Kaweah(?) Siliman Creek.	S. L. N. Ellis	Volcano Creek	*Salmo roosevelti*
1897	Nelson Creek (tributary of the Tule River)	J. M. Nelson	Volcano Creek	*Salmo roosevelti*
1900	Rock Creek	M. W. Bullington	Volcano Creek(?)	*Salmo roosevelti*
1906	Exhibited in San Francisco; taken to Sisson Hatchery.	R. W. Requa	Cottonwood Creek	*Salmo agua-bonita*
1908	Whitney Creek	Sierra Club	Whitney Meadows	*Salmo roosevelti*
	Crabtree Meadows	Sierra Club	Whitney Meadows	*Salmo roosevelti*
	Rock Creek	Sierra Club	Long Meadow	*Salmo roosevelti*
	Lake at head of Rock Creek	Sierra Club	Rock Creek	*Salmo roosevelti*
1908	Gardner Creek	George Hall, Ben Ransom	Little Whitney Meadows	*Salmo roosevelti*
1909	Gardner Creek (South Fork of Kings)	E. H. Ober, Geo. Hall, Ben Ransom, Frank Lenott and Sam McMurray.	Little Whitney Meadows	*Salmo roosevelti*
1909	Grouse Meadows and lakes in vicinity	E. H. Ober, Henry Bell	Whitney Meadows	*Salmo roosevelti*
1909	Crabtree Fork of Big Kern	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	North Fork of Kaweah	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	Whitney Creek	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	Guitar Lake	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*

	Rock Creek	S. L. N. Ellis	Whitney Meadows	*Salmo roosevelti*
	Lakes on Rock Creek	S. L. N. Ellis and J. H. Shallenberger	Whitney Meadows	*Salmo roosevelti*
1910	Waters flowing into Big Kern from east; Lake South America; Rock Creek; Perrin Creek; Table Creek; Guyot Creek; Lake Monotha; Monotha Creek; Lake Bernice; Neds Lake; Lake Aldula; both branches East Fork of Big Kern; Crabtree Creek; Lone Pine Creek; Kaweah Deadman's Creek.	S. L. N. Ellis, E. C. Ferguson, Ray C. Ellis.	Whitney Meadows	*Salmo roosevelti*
1910	Clover Creek; Boggy Meadows; Freeman Creek; Lloyd Meadows; Peppermint Creek in five places.	A. D. Ferguson, S. L. N. Ellis, Ray C. Ellis.	Little Kern	*Salmo whitei*
1910	Headwaters of the South Fork of Kings River, upper basin; Bench Lake, center basin; head of Bubbs Creek, East Vadette Meadows	E. H. Ober, George Hall, Sam Murray	Volcano Creek	*Salmo roosevelti*
1911	North Fork Kaweah; Indian Basin Creek; Traweek Creek.	F. A. Bullard	Volcano Creek	*Salmo roosevelti*
	Sisson Hatchery	Jack Broad, K. L. Hughes, S. L. N. Ellis, F. A. Bullard, A. D. Ferguson	Volcano Creek	*Salmo roosevelti*
1913	Unnamed lakes and small streams of Kern River; watershed lying west of Whitney Divide and drained by Tyndall Creek, Whitney Creek, Crabtree and East Fork of Kern.	S. L. N. Ellis, E. W. Smalley	Big Whitney Meadows	*Salmo roosevelti*
1913	West Fork of Roaring River (tributary to South Fork of Kings River) and streams and lakes tributary to Deadman's and Sugar Loaf creeks.	S. L. N. Ellis, E. W. Smalley, F. A. Bullard	Whitney Meadows	*Salmo roosevelti*
1914	Desolation Lake; unnamed lakes on south side of Piute Creek; Piute Creek; French Canyon Creek.	S. L. N. Ellis, E. W. Smalley, A. D. Ferguson, P. G. Redington, F. A. Bullard, O. P. Brownlow and others.	Whitney Meadows	*Salmo roosevelti*
1914	Heart Lake; Marie Lake; headwaters of Bear Creek; Shadow Creek.	F. A. Bullard, O. P. Brownlow	Whitney Meadows	*Salmo roosevelti*
1914	Shadow Lake; Garnet Lake; streams in vicinity of Thousand Island Lake, tributary to South and Middle forks of San Joaquin; Middle Fork of San Joaquin at Agnew Meadows.	F. A. Bullard and O. P. Brownlow	Whitney Meadows	*Salmo roosevelti*
1914	Tributaries of upper Big Kern; lakes in vicinity of Mount Geneva; Craig Ericson; Cliff Creek; Middle Fork of Kaweah; Lone Pine; Meadow Lake; Tamarac Lake.	Carl Westerfeld, R. D. Duke, A. D. Ferguson, S. L. N. Ellis, F. A. Bullard, O. P. Brownlow and others.	Whitney Meadows	*Salmo roosevelti*

Date planted	Lake or stream	By whom planted	Source of supply	Species
1914	Horse Corral Creek; Lewis Creek; Wildman Creek; Slide Creek; Kennedy Creek and tributary lakes; lake at head of Lost Canyon; Grizzly Creek at Burns Meadows.	F. A. Bullard, Walter Williams	Whitney Meadows	*Salmo roosevelti*
1917	Vicinity of Mount Whitney Hatchery	F. A. Shebley	Spawning station to Whitney Hatchery (station is on Cottonwood Lakes).	*Salmo agua-bonita*
Sept., 1919	Head of Little Pine Creek; South Fork Lake on Big Pine Creek.	E. H. Ober	Mount Whitney Hatchery	
Oct., 1919	Two lakes at head of Wood's Creek; Southeast Fork of Kings.	E. H. Ober	Mount Whitney Hatchery	

THE GROWTH OF THE SWELL SHARK WITHIN THE EGG CASE.*

By Helen M. Edwards.

On March 17, 1920, a young shark in the egg case was received from Mr. Kiati Nasu, secretary of the Southern California Fishermen's Association, through the kindness of Mr. E. M. Nielsen, of the Fish and Game Commission at San Pedro, and of Mr. Lingle, of the Bureau of Fisheries, who brought it to Hopkins Marine Station, Pacific Grove. The development of the fish has been watched with much interest, because the species was unknown and the process of development had not been seen in any of our western sharks.

Upon receipt of the shark it was placed in a small salt water aquarium with running water, where it was kept during its development. At various times the aquarium was out of order, which made it necessary at such times to change the water on the fish two or three times a day or to move it into another aquarium. It is a question whether or not the process of development was retarded or hindered in any way by these disturbances. We are under obligation to Stanford University and to Dr. W. K. Fisher, the director of Hopkins Marine Station, for the use of the aquarium.

The case, as shown in the accompanying drawing, was 116 mm. long and 49 mm. wide. One end, comprising about one third of the length of the case, was considerably smaller, and of a different shape from the larger end. The acute angles of the latter met and continued in long slender tendrils, for the purpose of attaching to seaweed, while similar tendrils were also given off from the angles

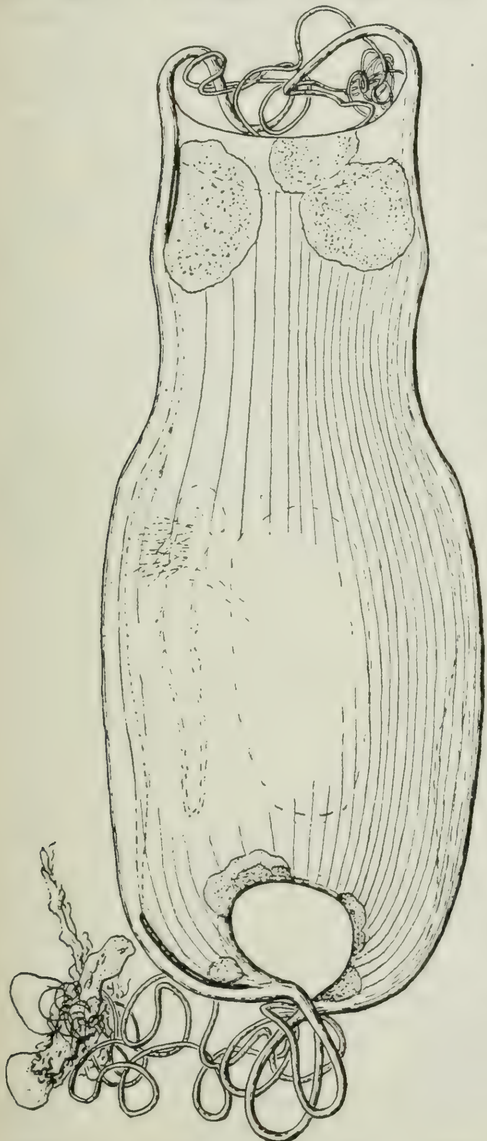

Fig. 39. Egg case of Swell Shark *Catulus uter.* Natural size.

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*California State Fisheries Laboratory, Contribution No. 20.

at the smaller end. The position and size of the fish and yolk, as seen through the opaque, dark brown, leathery case, are indicated in the drawing by broken lines. The fish was probably very young, for its length at the time of receiving was 43 mm., which exceeded the yolk by only 3 mm. The egg case had growing on it at each end colonies of bryozoans, which died and had soaked off by the end of four months.

At first there were no apertures in the case which could be detected, although each end contained two slight grooves, shown in the figure, situated on opposite sides of the case. To one facing the egg case, with the smaller end up, one groove was visible at each end on the left hand side. The other two grooves could not be seen without turning the case over, which would bring them on the left hand side. Those at the larger end were about 20 mm. long, and those at the smaller about 11 mm. On April 3 a small air bubble was visible inside the case, which proved the presence of an aperture. Upon examining the case and squeezing it gently it was found that water squirted out through a small slit at the larger end, which was one of the grooves beginning to open. By April 15 the other groove at the larger end and on the opposite side had opened. A little carmine was placed with a pipette near the apertures, but no marked current was visible. By May 20 both of the grooves at the smaller end had opened. These apertures, when completely opened, were about 1 mm. wide.

Attempts were made to measure the fish, but the results are only approximate on account of the opacity of the egg case, and of its constant activity, especially at first. The measurements were not taken at regular intervals, but the following table will give some idea of the rate of growth:

Date—1920	Length of Fish	Width of Head
March 17	43 mm.	
April 15	60 mm.	
April 29	67 mm.	
May 20	81 mm.	
May 25	87 mm.	16 mm.
June 7	104 mm.	19 mm.
June 17	115 mm.	22 mm.
June 24	123 mm.	25 mm.
July 6	130 mm.	26 mm.
August 19	155 mm.	27 mm.

Measurements were also taken of the yolk, the diminution of which is shown by the following table:

Date—1920	Length of Yolk Sac	Width of Yolk Sac
March 17	40 mm.	
April 15	37 mm.	
April 29	37 mm.	
May 20	35 mm.	
May 25	31 mm.	20 mm.
June 7	27 mm.	17 mm.
June 17	24 mm.	13 mm.
June 24	20 mm.	12 mm.
June 28	17 mm.	
July 1	14 mm.	
July 6	10 mm.	
July 17	5 mm.	
July 28	3 mm.	

Up until April 15, the yolk, though shortening, had kept the same general oval shape. At this time it became narrower and somewhat

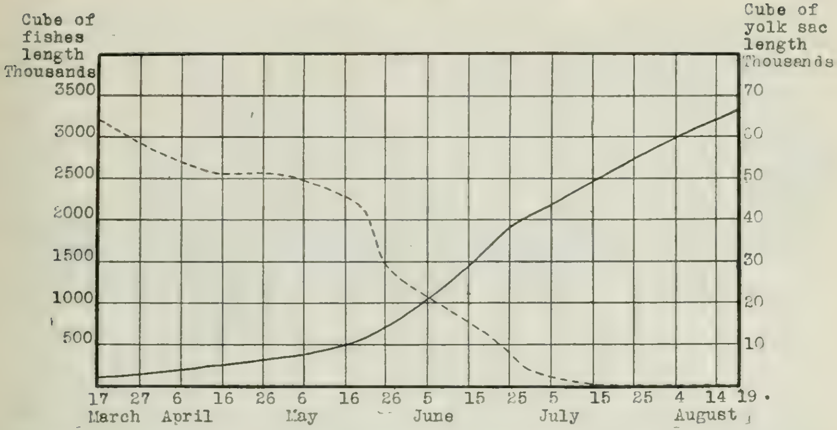

FIG. 40. Rate of growth of body and diminution of yolk of Swell Shark.
——— Bulk of fish according to cube of length.
– – – – – Bulk of yolk according to cube of length.

irregular in outline, but resumed the more oval appearance about May 25. By July 17 the yolk seemed to be entirely absorbed, leaving only a small round sac at the end of the umbilical cord, which was only about one-half of its original length, and by July 28 was reduced to less than an eighth of an inch and gave the appearance of a tiny knob on the ventral side of the fish. After hatching the only evidence of the cord was a little spot about the size of a pin head.

The rate of growth of the fish and the diminution of the yolk are shown in the accompanying chart. It will be noted that after the external yolk had been absorbed, about July 17, the fish continued steadily to grow, due probably to an internal supply of yolk. (See diagram.) Note also that from April 15 to 26 there was no change in the yolk shown in the curve, probably due to the fact that at this time the yolk was changing in shape somewhat and becoming narrower, while the length remained constant.

By May 20 the gill filaments, which were long and kept in constant motion by the movements of the fish, had entirely disappeared. They had been present in each gill slit and in the spiracles. Subsequent to this the breathing motion of the mouth was observed.

The color of the fish in the early stages was a uniform whitish. On May 25 a few dark spots were observed on the fins and by June 7, over ten weeks

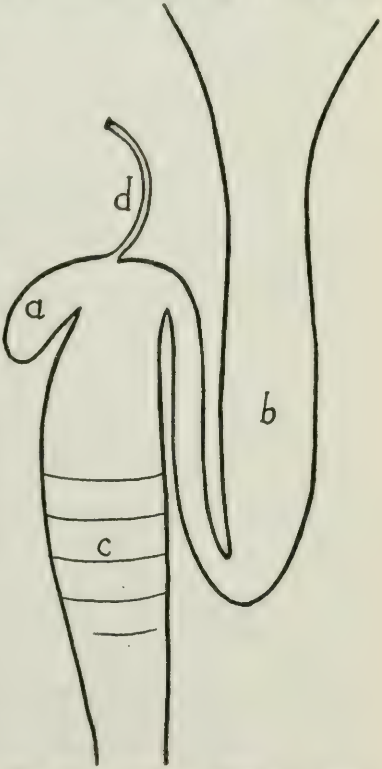

FIG. 41. Diagram showing internal attachment of so-called umbilical cord. *a.* Solid body filled with yolk. *b.* Stomach. *c.* Spiral valve. *d.* Umbilical cord.

before hatching, nearly the whole body was covered with about eight or nine pairs of black bands. At the time of hatching this distinct band effect was somewhat destroyed by the round black spots scattered on the bands.

The fish showed extreme activity at first, wriggling constantly and rhythmically, so that the taking of measurements was quite difficult. The most persistent motion was the back and forth movement of the tail, but occasionally the fish would curl itself into a tight knot and sometimes exhibit such violent activity, wriggling, squirming and flopping about, that it seemed likely to wrench itself loose from the yolk. Such violent activity usually lasted only a few seconds. Most of the time the movements of the tail back and forth were quite regular, while at other times they were very irregular and jerky. These were counted at various times and under various conditions. They seemed to be fewer and more regular in the shade than in sunlight. The experiments were as follows: when the fish was put in a shallow pan and placed in the shade, the tail moved very regularly back and forth from 60 to 70 times per minute; then when placed in the sun the motion became irregular and the count increased to as many as 120 per minute; the fish being placed in the shade again they were irregular and many at first, then dropped down to 78 per minute and became very regular; the pan being again placed in the sun, the movements were only 63 and very regular at first, but soon increased to 115 and were irregular; put back in the shade they decreased to 94. The probable purpose of the movements of the tail was to aerate the water by keeping it in circulation. By May 25 the fish did not show such constant activity. There would be long intervals of very little movement, if any, but at this time when the tail was in motion there were 110 movements counted per minute.

The night of May 25 the fish was left in the shallow pan on the table over night, on account of the failure of the water supply, and the next morning the sun had been shining upon it for some time until the water was almost hot. The fish was stretched out on its back with its mouth wide open, and showed no signs of life whatever. The water was cooled gradually, and within an hour the fish was as active as ever.

As the shark grew larger the activity decreased decidedly. By June 7 it was very inactive. Immediately after it was transferred from the aquarium into a glass jar, there were counted 125 movements per minute of the tail, and then all motion ceased until the fish was placed in the sun, when the activity was resumed. The light of the sun seemed always to increase the activity. When the egg case was handled or poked the fish would curl its tail around the yolk, then remain quiet. By June 17 the tip of the tail when curled around the yolk would reach the tip of the snout. During the last two months of its existence in the egg case, the fish was most inactive and the mouth movements were not always perceptible. At such times it was doubted if the fish were still alive. It was usually, however, with the exception of the last two weeks, sensitive to a jar of any kind. There was evidently more activity than was observed, for the head of the fish was not always in the same end of the case.

The evening of August 19, five months after having been received, the egg case was hanging perpendicularly in the water with the smaller end up, and the head of the fish toward this end. During the night the shark struggled up through this small end, splitting it entirely across the top, freed itself from the case, and was found the next morning reposing on the bottom of the aquarium. The egg case was then examined and it was found that beyond this opening through which the fish had slipped the case was unbroken. One of the slits at this end had aided in making the exit a little larger. The shark was very inactive and remained in one place for a long while, only occasionally moving the fins or tail slightly. During the day it moved about somewhat on the bottom of the aquarium. The next day it was taken out and identified as *Catulus uter,* Jordan & Gilbert.

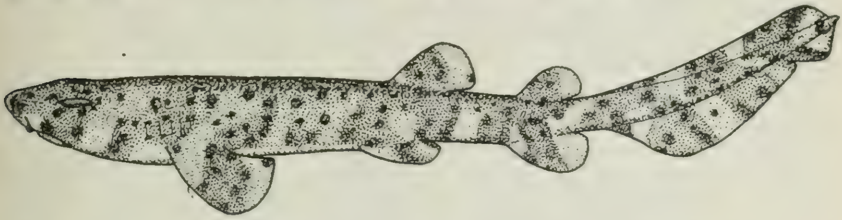

FIG. 42. Swell Shark, *Catulus uter,* the day after hatching. Natural size.

Figures showing the egg case and the fish immediately after hatching accompany this article.

NOTES ON DRY-FLY FISHING. No. 5.

By R. L. M., California.

SCENE: Camp fire in front of the hotel.

TIME: Evening of the day described in the July issue of California Fish and Game.

Dramatis personæ:

ANGLER.
TOURIST.
MRS. TOURIST.
SECOND TOURIST.
THIRD TOURIST.

Tourist: Here comes Angler. He promised to come around after supper. Angler, let me introduce you to my wife and the rest of our party.

Mrs. Tourist: Those trout we had for supper were delicious. They were so very much better than those that we caught at Pine Lake. I wonder why?

Angler: The fish we caught were stream fish and were in the pink of condition, for they had been feeding on insects, which is the best kind of food for a trout. Furthermore, they were in their natural environment. On the other hand, the fish in Pine Lake were Steelhead trout that, due to the formation of the country, can not run to the sea. The result is that their natural period of spawning is delayed, and I expect you saw the fish that you caught were not so plump as the stream fish were.

Second Tourist: They did not seem to put up much of a fight when hooked. They just gave one jump and then were brought in without any further struggle.

Third Tourist: Don't the fish in Pine Lake ever get into good condition?

Angler: In about six weeks time there will be a great change in them. It takes time for them to recover from spawning, particularly so as they have to get back into condition in a fresh water lake, rather than in their real environment, the sea. Early in the season they are good, but they begin to fall off about the middle of June, and it is not until the latter part of August that they become fit again.

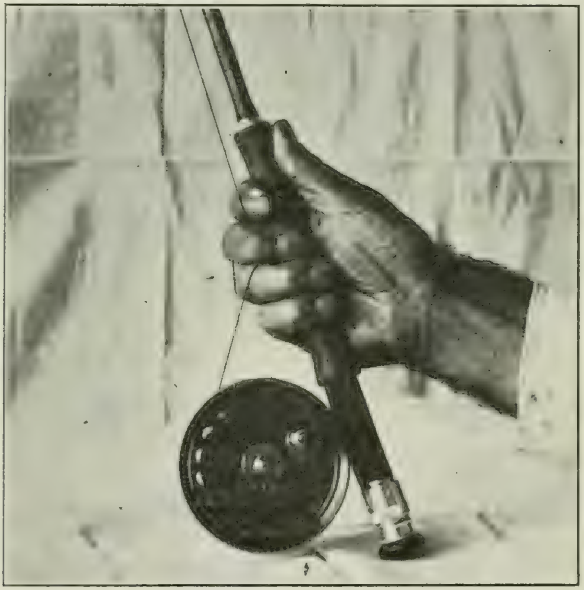

FIG. 43. Proper method of holding dry-fly rod. Photograph by R. L. M.

Mrs. Tourist: My husband has been telling us of the wonderful sport you had today. I wish we had been along instead of going over that rough road to the lake.

Second Tourist: Why didn't you begin to fish as soon as you reached the river? Tourist tells me that you waited for nearly half an hour before you began fishing.

Angler: When trout are not feeding on the surface it is very difficult to induce them to rise to a dry fly. One or two authorities on the art have stated that when the exact position of a fish is known, it can sometimes be coaxed to take a dry fly, if the fly is floated over it a number of times. In order to be successful, it is necessary to cast as many as twelve or more times over the fish. Each cast has to be letter perfect and the fly should not be lifted off the water until there is absolutely no chance of frightening the fish. One mistake spoils everything. If the suspicions of the fish are once aroused, he loses all interest in the proceedings.

The theory is that by making a number of casts over the fish, you create in his mind the belief that there is a hatch of some fly coming on, and so long as no mistakes are made, the effort may eventually be successful. The fish in this river, however, seem to feed mainly on grasshoppers, and during the time that the grasshoppers are present in large numbers they pay very little attention to anything else.

Third Tourist: Don't the fish feed in the evenings, when there are generally lots of flies on the water?

Angler: Not during the time of the harvest of 'hoppers. You will notice a lot of small fish and some chubs feeding on these flies; but the larger fish are resting while their heavy meal of 'hoppers is digesting. Whenever you happen to be fishing in a stream where you know there are good-sized trout and you catch nothing but small ones, you can make up your mind that the big fellows are not feeding. When they do feed the little trout keep out of the way.

Second Tourist: Then as I understand it, when the fish are not feeding on the surface, a dry fly is not much good.

Angler: That is correct with one exception—there is of course the possibility of getting an odd fish by creating an artificial rise of fly. When the dry fly does not produce results, then we change over and fish with a wet or sunk fly and quite possibly get some fish.

Third Tourist: Why didn't you fish with a wet fly while you were waiting this morning?

Angler: First of all, I knew it was only a question of a comparatively short time before the 'hoppers would begin to fly. Then, again, these fish are shy. They are very wary and not easy to catch, as the result of the continual fishing that goes on day after day throughout the entire open season. I considered it best not to add still further to their education by raking the water with a wet fly when I was so sure that they would soon be feeding on the top.

Tourist: You remember speaking about "drag"? Should a dry fly always float with the stream and never move at all on the surface?

Angler: In general, yes. But there are times and occasions when a deliberate drag, that is, a drag produced by the fisherman himself, may get a fish to rise, when possibly if no drag had been made, he would pay no attention to the fly.

Second Tourist: This sounds interesting. Can you give an example from your own experience where a forced drag was successful?

Angler: Yes. A few weeks ago I was fishing farther north. During the latter part of the afternoon a lot of small sedge flies hatched out and got onto the water. These flies belong to a different family than that to which the majority of the flies that we see belong. The sedge flies light on the surface; fly up a short distance and light again. When they are on the surface, they frequently move, sometimes even running along the top of the water for a short distance. In olden times the antics they performed earned them the name of "caperer." On several occasions on this trip I placed my fly over a rising fish without any result. The fish was not "put down," because it went on rising. Finally, I decided to see what effect it would have if I made my fly copy the motions of the flies on which the fish were feeding. I had already cast three times for the particular fish that I was going to experiment on. However, I cast and as soon as the fly got near the place where the fish was feeding, I deliberately made the fly move slightly on the surface of the water. Well, the fish fell for it and I got him all right.

The same scheme worked again successfully once or twice, but until it has been further tested, it can not be regarded as a standard tactic to adopt. There will always be the doubt, "would not the fish have taken the fly without the artificially-produced drag?"

The fish in that section were harder to catch than the fish here in the river.

Second Tourist: Well, all I can say is—they took "some" catching if they were harder to catch than these boys here. Yesterday I fished for fully two hours, and never got a single bite. At home, I can always get a mess of trout without any trouble at all.

Third Tourist: Back where we come from, we never see as many people fishing as we have seen here. I expect that has something to do with it.

Second Tourist: You spoke of "drag" just now. I don't quite get you. What does it mean?

Angler: "Drag" is a term used to define the unnatural movement of the artificial fly on the surface of the water. The duns and spinners, Ephmeridæ, do not move on the surface, they merely float quiescent. Now, if an artificial fly that is intended to represent one of this family should suddenly start across the water leaving a wake behind it, the suspicions of the trout would be aroused at once and it would undoubtedly let "that queer acting fly" pass on. If they are very wary, they stop feeding for awhile, or as the expression goes they are "put down," which means that they gently sink to the bottom of the stream and do not come up again for some time.

The water, where I experimented with a forced drag, was very slow moving, so much so that to all intents and purposes, there was no current at all. The surface was like polished glass. Unless there is a breeze to ruffle the water the fish are always difficult to approach under such conditions. The forced drag was successful when there was no air stirring. As I remarked before, the fish were feeding on a small sedge fly. I had only one fly of this type with me, namely, "the Welshman's button." The fly was so totally unlike the natural one that I did not expect to do any good with it. However, I had lately been reading a book by "Red Quill" (James Englefield), who is an authority. He stated that he fished an entire season with only one pattern of fly, namely, the "red quill." He used it rain or shine, when the fish were rising to duns or spinners, and also when they were feeding on sedge flies. Thinking of his success I put on a small red quill and had some very satisfactory results from it. I also tried a Wickham's fancy, and was not exactly disappointed with what took place.

Third Tourist: But tell us, what causes "drag" and how can you prevent it?

Angler: There is not much danger of a "drag" where the surface currents are steady. But if the stream is faster or slower at the spot where the feeding fish lies than it is between that spot and the place where you are standing, there is bound to be a drag if your line falls straight across the water.

Third Tourist: But why?

Angler: Because as soon as the line begins to float down, the swifter portion of the surface makes the line belly out. This causes the fly at the end to move toward the belly of the line, in other words, to "drag" on the surface. This can be corrected, to a certain extent, by causing the line to fall in a curve, either up or down stream, as the current requires.

Second Tourist: But how can you make the line fall as it should?

Angler: By making the cast in a horizontal plane—side stroke—instead of a vertical plane, or overhead stroke.

Third Tourist: Tourist tells me that you hold your reel with the handle pointing to the left. Don't you find it rather awkward to wind up the line with the left hand?

Angler: Not so that you would notice it. I have brought some of my junk along and by using it to demonstrate with, I may be able to explain why I do this. Incidentally, I might remark that professional opinion tells me that my method is the right way, or as an authority recently told me, it is "academically the right way to fish."

Mrs. Tourist: What do you call "professional opinion?"

Angler: The expressed views of some of the leading manufacturers of fishing tackle.

Now, here is my rod with the reel on it. (See Fig. 43.) You will observe that I hold the line with my second finger. It has the longest reach and consequently I can, without moving the rest of my hand, get hold of the loose line and secure it with less trouble than any of the other fingers. To release the line, when I have hooked a good, gamey fish, I merely straighten out my finger for a moment. If I use the reel in this manner I am never bothered with slack line, for as soon as the fly is delivered, I wind up any line that may be hanging in a loop. The second finger reaches out and hooks onto the line and brings it down to the hand grasp as you see now. If the handle of the reel stuck out to the right I could not do this, unless I had a third or supplementary arm and hand on the right side. I will admit that with one exception all the angling writers advocate the handle of the reel to the right, but anyone who has tried the other way and learned how to wind with the left hand, which is extremely easy to do, never goes back to the other position.

Third Tourist: There is something in that. But don't you find that you lose more fish your way?

Angler: My experience has shown me that adopting my method produces just the opposite result. For instance, I was fishing in a place where the fish, although they were large, were few and far between. One day I kept careful count of the rises I had. They totalled exactly three: not thirty-three, but three. How many of those rises do you suppose I hooked?

Tourist: One out of three would be a fair average. Two out of three would be remarkable. How many did you hook?

Angler: All three. Two of the fish were landed; the third got off by coming a few feet towards me and darting off under a sunken log. I couldnt keep him out because the only possible method would have been to push him away with the line, which was impossible.

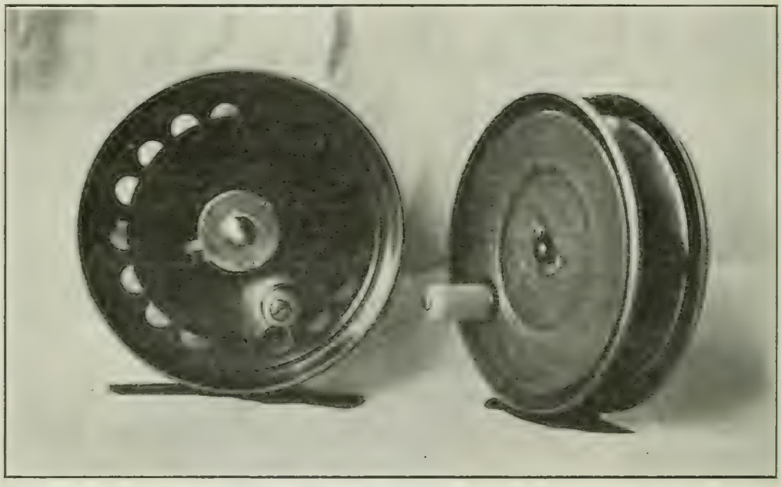

FIG. 44. A good type of reel for a dry-fly rod. Photograph by R. L. M.

Second Tourist: Won't you show us the rest of your paraphernalia?

Angler: Here are a couple of modern fly reels. (See Fig. 44.) They are short length spools of large diameter. Consequently, you can wind up line very fast with them.

Third Tourist: Did you ever use an automatic reel?

Angler: No. I do not think that they are satisfactory. The reel, besides being used as a device to care for the spare line, acts as a counter weight and balances rod. The weight of an automatic reel is so great that it overbalances any normal fly rod.

Here is an old-time fly box. This is known as the "Houghton" fly box and has been made for a number of years. I have had this particular one ever since 1899, but it is still in fair condition.

Tourist: Why the "Houghton"?

Angler: It is named after a famous old fishing club of that name. Ever since 1822, the club has leased or owned riparian rights on the

Test, a river in the south of England, which is noted for its trout fishing and more particularly for the dry-fly branch of that art.

Mrs. Tourist: You have quite a nice collection of flies in that box. I notice that they seem to be graded from quite dark flies to some that are nearly white in their general makeup. Is it necessary to have many different kinds of flies?

Angler: Not absolutely. There are twelve different patterns there. As a general rule, there is sufficient variety in such a collection to find the right fly for the fish. The grasshopper fly is not there, but that fly is more or less a purely local pattern. By that I mean, it would be worse than useless, unless, the fish were feeding on 'hoppers.

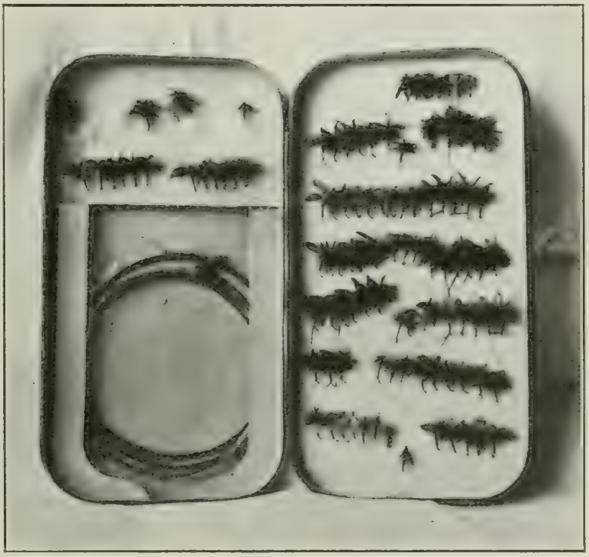

FIG. 45. Fly box and dry flies. Photograph by R. L. M.

Mrs. Tourist: What are the names of your flies?

Angler: Well, here I have the red quill. These are Wickham's fancies. For a very light-colored fly, I use this, which is called Kingsley's cocktail spinner. The opposite, or the prince of darkness, is this one, which is known as Greenwell's glory. This is the medium olive dun, and this one is the witchurch dun. Then here is that old standby the hare's ear. This fly won distinction, for it was with it that the largest trout ever caught with the dry fly was hooked.

Third Tourist: How big was it?

Angler: It weighed twelve and three-quarters pounds and took one hour and a quarter to land. Its fortunate captor was the Reverend S. E. V. Filleul of Wareham.

Third Tourist: Some fish, I'll say so!

Angler: This fly is the whirling blue dun, and here we have the pink lady, the invention of Mr. George M. La Branche of New York. This animal with no wings is Tup's indispensable, which is supposed to represent the fly just at the moment it reaches the surface, before it has gotten rid of its outer skin and put its wings out. Finally, here we have the "whole dam dun family" and the "blood relation" or "first cousin" to the "dam dun family."

Second Tourist: Why such a name for a poor inoffensive fly?

Angler: This fly is intended to be a composite portrait of all the duns. Its cousin is a slight variation with woodcock wings and is very useful when the march brown fly is on the water. These two are my own design.

Second Tourist: Are they any good?

Angler: Well, the first time I used "the family" I got hold of a big trout that escaped by promptly getting down between some rocks and sawing off my leader. The next day at almost my first cast with the same fly I got a three-and-a-half-pound fish and long before it got dark or even the cows came home, I had caught the limit.

Mrs. Tourist: Which is your favorite fly?

Angler: The grasshopper, when the fish are feeding on it. But when they are feeding on small flies I have no first choice. The fact of the matter is that one fly is as good as another provided the size is right. The most important thing is to have confidence that the fly you are using is the one and only fly to use. If you can attain to this degree of perfection then you will catch fish. However, we are human and we have our doubts and in order to be on the safe side it is just as well to have a variety of flies along, even if you do confine yourself to only one or two patterns.

Mrs. Tourist: Well, we have had a most delightful visit, and if ever you come our way you must certainly come out to the ranch and have some fishing where there will not be so many people fishing all around you.

Angler: Here are a few grasshopper flies that may be useful in the future.

Tourist: Many thanks. And good luck to you.

CALIFORNIA FISH AND GAME

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OCTOBER 28, 1920.

It cannot be expected that wild life resources, if left to themselves, will continue to yield food and sport indefinitely. A constant supply can only be maintained through carefully planned protection and propagation, and the necessary expense involved in such an undertaking is justified by any results which are as outstanding as those of fish and game.

COMMISSION'S DUTY TO PROTECT FISH AND GAME.

We often hear unjust criticism of the Fish and Game Commission, because of the wrong attitude taken by many sportsmen. There are many persons who seem to think that the hunter or fisherman is better qualified to dictate as to what the law should be than the Fish and Game Commission. They fail to realize that they view questions from rather a selfish point of view. The members of the Commission are in a better position to know conditions and to judge as to needs than any individual or group of individuals, for it is their business and not simply their hobby. The Fish and Game Commission must stand as a barrier to protect fish and game. It takes into account the safety of the different species more largely than the desire of the man who hunts and fishes.

SUMMER RESORT EDUCATIONAL WORK.

The educational work in the Yosemite National Park carried on under the joint auspices of the National Park Service and the California Fish and Game Commission this past summer proved to be very popular and very much worth while. The work was designed to bring useful information regarding wild life and the methods of conserving it to the summer vacationist. The term "Nature Guide Service," applied to it, but partially explains the different fields of endeavor. In addition to the scheduled field trips for both adults and children, formal lectures and campfire talks were given at the various resorts. Such game birds as the band-tailed pigeon, mountain quail, Sierra grouse and spotted sandpiper encountered on the different field excursions gave splendid opportunity for the discussion of the present status and the methods for the conservation of these different game species. Wild life films and stereopticon slides were used to illustrate the lectures. An office hour held at the National Park Service office gave Yosemite visitors a chance to have questions answered. A total or nearly 1400 persons, a large number of whom were children, were given first hand information regarding birds, mammals and fish through the medium of field trips, and over 25,000 persons through the medium of lectures. Thus does the plan grow for making "conservationists out of summer vacationists."

THE GRIZZLY.

In the Conservationist for August, 1920, Mr. Enos Mills has contributed a short appeal on behalf of the vanishing grizzly. The need for the protection of this splendid animal in California was not appreciated soon enough. California, where the grizzly was but a short time ago found in considerable numbers, is now without a single representative, and it is to be trusted that the people who live in the sections of our country where he is still to be found will not be so short-sighted.

Mr. Mills says: "The grizzly is distinguished by keenly developed senses, alertness, sustained curiosity, and superior mentality.

"Although the grizzly in not ferocius, and although he does not eat human flesh, most people unfortunately believe the contrary. One is as likely to be assaulted by a jack rabbit as by a grizzly, and far more likely to be chased by a tame cow or a civilized dog.

"The grizzly destroys many pests—rats, mice, rabbits and grasshoppers. Most of his food habits are economically beneficial to mankind. Exceptional grizzlies have turned cattle killers; but cattle or big game killing is confined to exceptional individuals and not to exceptional doings of all grizzlies.

"The grizzly has courage, loyalty and individuality. * * * Our race loses if the grizzly goes. He is the master touch to arouse the imagination, to perpetuate the strange primeval memories, to give the wilderness its supreme spell."

We hope that the conservationists who are interested in the protection of this monarch of the wilds will be successful in spreading the gospel of their conservation and that early attention will be given the black bear that it may not follow the grizzly.

BEAVERS INCREASE IN THE ADIRONDACKS.

A careful study of the beaver in the Adirondacks has shown that this furbearer is now so abundant that an open season is not only safe but necessary to prevent too much damage being done to timber and cultivated crops. In the day of the trapper the annual exportation of beaver pelts from New York State alone amounted to 8,000. This was in the days of the beaver hat, in the year 1663. By 1820 beavers were so reduced in numbers that they probably numbered a little more than 1,000 in the Adirondacks. In 1895 it has been estimated that there were not more than five or ten animals left in this same region. About this time efforts were made by sportsmen to not only protect the beaver, but to restock some of the streams. In 1906 some actual restocking took place, 34 beavers in all were released during the restocking period, and at the present time, 14 years later, the beaver in the Adirondacks are easily estimated at from 5,000 to 10,000. Beavers are now so abundant that considerable damage is caused by flooding timber areas and obstructing navigation.

The simple remedy for the conditions as they now exist is to ask the New York Legislature to open the season on beavers, and this will be done.

This is another case similar to that of the deer in Vermont, where restocking proved eminently successful. Wild animals have wonderful powers of recuperation and if given a chance will quickly restock the area. Better, however, than restocking is the conservation of a sufficent breeding stock.

STATE FAIR EXHIBIT.

The exhibit at the State Fair which drew so much favorable attention last year was remodeled and improved for the 1920 fair. The observation platform was moved farther away, additional foothills were added and a miniature electric train, with bridges and tunnels, was installed and better lighting effects supplied. It will be remembered that the exhibit is a cyclorama, showing the Sierra from Mount Shasta on the north to Mount Whitney on the south, with miniature hatchery buldings in the foreground, and still nearer in the foreground a large lake containing live trout. Of particular interest this year were the added cloud effects. While changing colors which light the mountains show the change from day to night. clouds sweep across the sky and later the stars appear. This is followed by the rosy tints of morning.

Visitors to the fair unhesitatingly stated that this exhibit was not only the finest exhibit on the fair grounds but the finest ever shown in the West, even exceeding any of those shown at the Panama-Pacific Exposition.

As in previous years there was a splendid aquarium display of food and game fishes, including the famous golden trout.

LAW LEGALIZES CARRYING OF GUN IN CLOSED SEASON.

At the last session of the legislature jack rabbits were placed on the predatory mammal list. thus not only allowing killing at all times but allowing the killing of them without a hunting license. Granting that the jack rabbit is a pest and needs no protection at the present time, yet this law gives the alien hunter and violator a chance to carry a gun the year around, thus making law enforcement particularly difficult. More and more it becomes evident that the carrying of a gun during certain seasons of the year should be sufficient cause for arrest. Otherwise, on the plea of hunting jack rabbits, the violator has a chance to be in the field during the closed season for quail and other game. All sportsmen should be alive to the danger if this law continues to stand on the statute books.

MORE TRAINED CONSERVATIONISTS.

That there is increased interest in wild life is clearly shown by the educational opportunities offered in institutions of learning. Cornell University has been offering splendid courses on game propagation and more recently there has been formed at McGregor, Iowa, the American School of Wild Life Protection and Propagation. The aim is to establish an institution that will not only fill the interest and needs of the individual student, but one which will at the same time further the discussion and elucidation of large questions, such as water supply, despoliation of forests and the indiscriminate draining of lakes. It will be remembered that there has been considerable agitation for a national park in the near vicinity of McGregor, consequently the location of this school is ideal. The faculty will be made up of noted scientists connected with Iowa State University, Morningside College, Cornell College and Iowa State College.

With a new fisheries college established at the University of Washington and the two institutions mentioned above, there should be no lack of trained men to fill situations connected with our conservation departments. It is to be hoped that there will be a larger body of trained men and that other institutions will be forced to offer work of a similar nature.

MUD-HEN STEW "HUNTER STYLE."

Many a hunter having bagged a mud-hen throws the bird away because he does not realize its food value. When properly cooked the mud-hen is delicious, only surpassed in flavor by the better ducks. Mr. W. W. Richards offers the following recipe, which has been used for many years at "Green Lodge", his duck preserve on the Suisun marshes:

Mud-Hen Stew.

Mud-hens.
½ pound salt pork.
1 medium sized onion.
Potatoes (as desired).
½ dozen cloves.
Half a bay leaf.
Salt.
Pepper.
1 teaspoon curry powder.
2 tablespoons flour.

Skin the birds—*do not* pick them—and soak them a few hours, or all night, in water to which has been added a little salt. Then remove the birds from the salt water and put them in a kettle containing sufficient water to cover them. Let the water come to a boil, then pour the water off; add half a pound of salt pork, cut in dices; cover with hot water, and let boil about one hour. Then add half a dozen whole cloves; one medium sized onion cut up fine; half a bay leaf; salt and pepper to taste; and peeled potatoes as desired.

Mix one teaspoon of curry powder and two tablespoons of white flour with enough water to make a smooth paste, and add this to the stew and let it cook about half an hour longer before serving it.

Serve with boiled rice as a side dish, if desired.

MAKING CONSERVATIONISTS.

What more unpleasant reflection could be made on the sportsmen and the people of the United States generally than in the statement quoted: "Though game protection in the United States is now more than two hundred years old, it has not protected the game?" As early as 1709 there was a closed season placed upon deer, wild turkeys, heath hens and partridges, in the state of New York, with a fixed penalty for violations of the law; and today the most important game animal in New York State is the rabbit. The wild turkey and heath hens are extinct and the deer and partridges are maintained only under the protective measures of the State Conservation Commission. However, such demoralizing evidence is of inestimable value if it makes the people of each and every state think of its own wild life and the best ways and means of affording it protection. New York has arisen to its responsibilities and can well be a splendid example to most states. Mr. Pratt of the Conservation Commission of New York believes that the crux of the whole problem is to be found in having laws, based on exact knowledge and biological investigation, carried out by an efficient game protective force.

There is no doubt that the value of having an intelligent, efficient, nonpolitical body of men as game wardens can hardly be overestimated. But of what lasting value was the Prussian military system without the united support of the entire populace? Of what value is any system without cooperation? Of major importance is the development of moral force, and this is accomplished through the education of the people. If the state game wardens can stand as educators of the people then, indeed, they can be even more justly proud of their worth. Make it the people's affair, the people's interest, the people's pride to protect the wild life in the state, and the people, not a small struggling minority, will protect the wild life of the country.

New York is visualizing the cause by an emblem designed for permanent use, a small celluloid card interpreting the emblem being given with each one. The cause is becoming popularized, and the creed is one which we should all stand for:

"I believe that 'God has lent us the earth for our life. It is a great entail. It belongs as much to those who are to come after us as to us, and we have no right, by anything we do or neglect, to involve them in any unnecessary penalties, or to deprive them of the benefit which was in our power to bequeath.'—Ruskin.

"That, in a great democracy of free people, the protection of wild life and the preservation of all other natural resources, which underlie national prosperity and happiness, must depend, finally, as does the stability of the government itself, upon the support and willing service of every citizen.

"I therefore declare my adherence to these principles, and have enrolled myself as an active Conservationist of the Empire State."

When the people carry this creed in their hearts rather than on a celluloid card in their vest pockets, the conservationist will have won his hard earned struggle. M. K.

PRESERVATION OF INLAND MARSHES.

Mr. E. W. Nelson, Chief of the United States Biological Survey, has recently pointed out the importance of furnishing migratory waterfowl with places where they can stop to rest and rear their young. Certainly one of the most important factors in the decrease of waterfowl is the reclamation of swamp land, which has furnished a food supply and safe breeding place for these birds. In the propagation of domestic birds we all know that the most necessary things are food supply, shelter and safe breeding sites, and it is not hard to see that wild birds are dependent for their existence on these same three things. The desire of the American people to commercialize absolutely everything is leading to the reclamation of marshes which in reality are more valuable as breeders of waterfowl than as agricultural producing areas. As Mr. Nelson has pointed out, the marsh lands under intelligent management will yield abundant returns to the community, as indicated in the following summary of their productiveness:

1. Production of food and game fishes.
2. Wild fowl, shot for sport and food.
3. Furs, from such fur-bearers as the muskrats, skunks, and raccoons which frequent their borders.
4. A natural ice supply.
5. A definite and invaluable help in maintaining the underground water level in various parts of the state, and in helping to hold back the runoff of rainfall to prevent excessive erosion.
6. Opportunities for healthful and interesting recreation for the citizens of the state.
7. Where such water areas are included in state parks or reservations, they lend themselves admirably to educational uses, and help interest the people of the state in out-of-door life and in the natural resources of the state in the form of plant and animal life.

That some states are becoming alert to the danger, arising from the demand to drain many bodies of water, is shown by the fact that the Conservation Commission of Iowa is working out plans which will permit the saving of desirable water areas from ill-considered drainage, and Minnesota recently, under the decision of the state courts, has saved water areas from drainage, on the ground of their value to the public in their natural state.

It is high time that California should be aroused to the danger which threatens the wild life of the state by the continuous drainage of water and marsh areas. Discussion along this line is timely and immediate effort must be made, if suitable areas for waterfowl are to be maintained.

ANOTHER SPORTSMEN'S CREED.

1. I deem it a point of honor never to shoot a sitting bird (except cripples). I will not pot-shot, and I will not stand for it in my party.

2. I will measure the success of my day afield not only by the size of my bag, but by the number of cripples I leave behind me. I would rather get a mess of game with no lost cripples, than to kill the limit and leave the woods full of lost game. Accordingly, I will shoot to kill, and *I will not shoot out of range.*

3. I am against "piecing out" the other fellow's limit. I am against the "dummy license." The legal limit applies to the man, not to the party. If I can't kill my own game I don't want anyone else to kill it for me, and I expect my hunting partners to look at it the same way. If they don't, they don't need my company.

4. I will not clean out a covey. "Leaving some for seed" is one of the first principles of sportsmanship.—"*The Pine Cone*," July, 1920.

THE AIRPLANE VIOLATOR.

Not long after the invention of the airplane, it was found that a man-made machine could easily overtake flying waterfowl and that hunting was thus made easy. Hunting from an airplane has grown in popularity and more than one state has found that some restriction must be placed in the game laws to prevent too great a toll being taken. Game law violators who ride in airplanes are difficult to apprehend, as are also the automobile violators. It will be remembered that at the last session of the legislature California prohibited the shooting of game from airplanes, automobiles, and sailboats, as well as from power boats while in motion. Of no less importance than hunting from an airplane, is the stopping of the shooting of hawks and other birds from an automobile. Not only are many hawks and other valuable birds killed by the man desiring something to shoot, but persons traveling along the same road are endangered.

FRANCE DEMANDS GAME REPARATION.

France is awake to the fact that part of the reparation owed her by Germany is to be found in the game destroyed in the regions where heavy fighting took place and in that which Germany took to augment her diminishing food supply. An association of French sportsmen have demanded that Germany repay the gunners of France by restocking the game reserves so entirely depleted by German invasion, rather than by making reparation with money. The sportsmen were so insistent in their demands that they convinced the reparation council of the importance of their stand, and France is now to demand from Germany and Austria live game to the value of 35,000,000 francs. Germany and Austria must each furnish, in four half-yearly installments, 250 stags, 1000 hinds, 200 male and 400 female roe deer, 200,000 male hares and 400,000 female and 3,000,000 brace of partridges. In addition, Austria must furnish 1,000,000 pheasants. The greater proportion of the game will be liberated immediately upon arrival, under the supervision of experts. The balance will be held on game farms as breeding stock, these farms to be controlled and operated by the French government.

FACTS OF CURRENT INTEREST.

Salmon have been caught on hook and line as far up the Sacramento River as Sacramento this season. It seems probable that the exceedingly low water, combined with an invasion of salt water far up the river, has had something to do with the unusual catch.

* * *

Angling interests have been threatened owing to the drying up of many trout streams and lakes during the past summer. It has been impossible to stock many streams which have heretofore been stocked annually, because of the lack of water.

* * *

Hunting is growing more and more popular as is evidenced by the report of the sale of hunting licenses.

* * *

The Fish and Game Commission's State Fair exhibit proved to be the most attractive one of the 1920 fair. The one complaint was that people were unable to see the exhibit owing to the crowds.

* * *

Live golden trout were displayed again this year at the State Fair.

* * *

A new state fisheries laboratory is now assured, as the city of Los Angeles has furnished the Fish and Game Commission a long-time lease on a site at Fish Harbor, San Pedro.

* * *

The normal kill of deer has been made during the past open season, and reports show that deer are on the increase in many sections.

* * *

Twenty-five to fifty persons registered daily at the Tahoe camp ground this past season.

* * *

The new Tahoe Hatchery constructed at Walker Springs at the north end of the lake has been completed and is ready for occupancy.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

TROUT DIE IN BEAR LAKE.

As is the case in most dry years, there has been a great loss of fish due to the drying up of lakes and streams. Stocking operations in many streams have had to be suspended this year because the streams were absolutely dry. Anglers in southern California have been justly disturbed over the death of thousands of fine large trout, many from three to ten pounds in weight, in Big Bear Lake in the San Bernardino Mountains. What the future of fishing in this lake, which has heretofore been the mecca of most of the anglers of Los Angeles and nearby counties, will be, remains to be seen. Many are the theories advanced as to the cause underlying the destruction of fish. No matter what the immediate cause, whether bacteria or chemical poisoning, the underlying cause is doubtless to be found in the dearth of water.

SMALL TAKE OF EGGS.

Low water in the streams where spawning operations are carried on has prevented a large take of eggs for the hatcheries. In many instances streams were so low that fish were unable to proceed up stream far enough to reach the spawning station. At the Snow Mountain egg collecting station, where a large take of steelhead eggs is usually made (from 4,000,000 to 6,000,00) less than one-fourth of the usual take was secured—750,000.

GOLDEN TROUT LACKS HARDINESS OF OTHER TROUT.

Although golden trout eggs are being successfully hatched and the fry reared in our hatcheries, yet the adult golden trout appears to be a difficult one to keep in breeding ponds. Several attempts have been made to keep the golden trout at the Mount Shasta Hatchery but without success. Golden trout exhibited at the State Fair at Sacramento last September were moved to Sisson, but all died. Just why this species should succumb while others thrive is a mystery, as shipments from Inyo County come through in good condition and no trouble is experienced in keeping them in aquária at the State Fair.

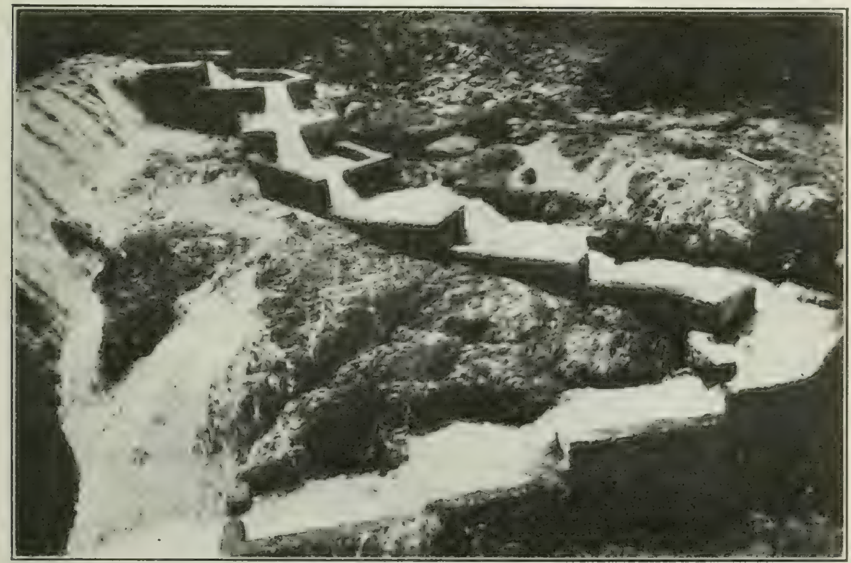

FIG. 46. A fine type of fish ladder. Inskip Dam, South Butte Creek, Tehama County, California. Photograph by A. E. Culver.

THE TAHOE HATCHERY.

The new Tahoe Hatchery is now completed and ready for occupancy. It has become more and more evident for several years past that the supply of water at the old hatchery site was entirely inadequate, and several years ago property about one mile east was secured, together with the water rights to Walker Springs. In fact the site secured is the only one available at the present time. The springs furnish a purer and colder water supply than any stream flowing into the lake. Furthermore, a supply of water from springs is more dependable than that from a stream, in that there is less danger of lack of water during a dry season. The new hatchery contains sixty-four troughs and will have a capacity of about two and a half million trout. Provision has also been made for breeding ponds and nursery ponds. A superintendent's cottage is being built.

This new hatchery is made the more necessary because of the lack of water at the Tallac Hatchery during the past few years. The new Tahoe Hatchery is of sufficient size to handle practically all of the black-spotted trout operations.

The old hatchery building will be utilized as a laundry and community center in connection with the camp ground.

THE OLD AND THE NEW.

In 1888 the Mount Shasta Hatchery consisted of one building, forty by sixty feet, containing forty-four troughs. Its capacity was a few hundred thousand trout and salmon. At the present time the Mount Shasta Hatchery comprises seventeen acres with five large hatching houses containing 450 troughs, together with superintendent's cottages, spawning house, kitchen, barn, sheds and garage. Fifty large rearing ponds for trout and three larger ponds for salmon complete the equipment. The hatchery output averages more than 10,000,000 trout and salmon per year.

FOOD FOR TROUT INTRODUCED.

The Department of Fishculture is endeavoring to conserve the fish supply by introducing new trout food in the lakes of the southern Sierra and Tahoe basin. Insects, such as salmon flies; crustaceans, such as gammarus; and aquatic plants are being introduced.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

THE STATUS OF THE TUNA.

The Fish and Game Commission recently received a letter from one of our leading sporting magazines calling attention to the fact that a seaplane had been used at San Pedro in locating schools of tuna. They also sent this Commission a letter which they had received from a Californian protesting against this "contemptible practice" as they called it, and stating that the "fish canning companies of the state by this method are destroying this wonderful Pacific Coast fish, the tuna."

As this is the kind of opposition which any new method of fishing receives whether it is actually destructive or not, the reply made is appended:

The tuna has been recognized as a commercial fish for many years in Europe. The only reason it has not been recognized as a commercial fish on the Atlantic and Pacific coasts of the United States is because we have not appreciated its value as a food fish. So far the tuna, which we call here the blue-fin or leaping tuna (*Thunnus thynnus*), has been taken in commercial quantities only a couple of years, and we are quite sure that the species is in no immediate danger of being exterminated or of being seriously depleted.

The albacore, which the United States Bureau of Food and Drugs permits our canners to label as long-finned tuna, and which is the whitemeat tuna found in the markets, has been taken commercially in large quantities for the last seven or eight years. The albacore is taken with hook and line only but the quantity taken in one season has been as high as thirty million pounds, or six times the weight of blue-fin tuna taken in any one year.

This Commission has been employing fisheries investigators for the past three years to make a thorough investigation of the albacore to determine if it was being overfished and likely to become seriously depleted in numbers. At the beginning of this investigation three years ago, there was available accurate data of the catch for three years preceding, so that now we have had six years accurate data of the catch upon which to pass an opinion as to whether it is being overfished. The evidence is quite conclusive that the albacore is not in danger of being depleted and we consider that it needs no protection as yet. The tuna which is mentioned in your letter is a closely related fish belonging to the same genus and it is not at all likely that it will be taken in large enough quantities to seriously deplete the supply for at least several years to come.

This state is collecting accurate data of the catch of each commercial species of fish and this data shows not only the total catches of each variety but the catch per unit of fishing gear. By means of this data we are keeping a better watch on the fisheries than is any other state and we will be able to detect depletion of any species before such depletion has advanced beyond the danger point. We are not taking it for granted that the resources of the sea are inexhaustible; we are going on the assumption that any species may be exhausted if we catch it in large enough quantities. We are watching the tuna fisheries as well as our immense sardine fishery very carefully and we wish to assure you that there is no cause for alarm in the fact that an occasional seaplane is used to locate schools of tuna.

As yet there is no demand in the markets for the canned blue-fin tuna, in fact, there is not the demand there should be and it is not likely that the fishing for blue-fin tuna will need restricting until the public do come to appreciate it as a valuable food product.

We do not consider the use of seaplanes in locating schools of fish as a "contemptible practice." This method of locating fish has been used but little on this coast. On the Atlantic coast, as you may know, the United States Government, with the sanction of the United States Bureau of Fisheries, is aiding the fishing industries to locate fish by this means. Seaplanes were used last fall at San Diego in locating schools of sardines. These seaplanes were furnished by the United States Navy and had the sanction and assistance of the State Fish and Game Commission.

BUREAU CHIEF INSPECTS CALIFORNIA FISHERIES.

Dr. H. F. Moore, Deputy Commissioner of Fisheries, made a tour of inspection of California fisheries and the United States Bureau of Fisheries' Preservation Laboratory at San Pedro during September on his return from the Pan-Pacific Science Congress at Honolulu. This is Dr. Moore's first visit to this coast for several years. A full week was spent on a survey of the fisheries, this being occasioned by the recent rapid growth of our fisheries and more especially by the fisheries conservation work now being done by the State Fish and Game Commission. Dr. Moore has expressed himself as being very favorably impressed with the conservation work under way in this state.

TUNA FISHERIES INVESTIGATED.

A recent visitor to this coast is Dr. Kamakichi Kishinouye, of the College of Fisheries, Tokyo Imperial University, Japan, who is making a special study of the comparative anatomy of the Scombroid fishes, or in other words, the fishes of the mackerel family. He finds that the yellow-fin and the blue-fin tunas have a remarkable set of blood vessels which surround the liver and extend into the strip of dark meat along the side of the fish, which strip is so noticeable in the fishes of the mackerel family. The albacore, or long-finned tuna, does not show this unusual development, at least in such a marked degree.

The remarkable part of this is that this particular arrangement has never been described by anatomists or fish investigators. It is believed to have some direct bearing on the fish's ability to withstand cold water.

Dr. Kishinouye is spending some time in southern California in order to make a study of this structure in the three species of tuna found in those waters, *i.e.*, blue-fin, yellow-fin and long-fin tuna. He also wishes to determine if these three fish are of the same species as those found in Japan. He suspects, from work he has already done on the anatomy of these fishes, that the Japanese blue-fin tuna is a different species from the one found in the Mediterranean Sea. Heretofore these two, as well as the blue-fin tuna found in California, have been considered the same species.

In Japan the blue-fin and yellow-fin tuna are caught by immense trap nets placed rather close inshore. The long-finned tuna, or albacore, cannot be caught in this manner as they do not approach the shore, living only in quite deep water. The albacore is taken to some extent in gill nets but the principal method of catching is by the use of long lines, similar to the lines used by the California Fish and Game Commission in its experimental fishing for albacore in southern California waters a year or so ago. They have found this the most successful way of catching albacore and the most economical. The principal bait used is fresh squid. The method of using hand lines and lines on short poles, as employed in California, is used only to a limited extent in Japan. It is his idea that the use of the short poles, which is known to our fishermen here as the "Jap pole method," is only successful at times when the albacore are very plentiful. The long lines, he states, are most successful in catching albacore in the spring and fall of the year, and these are the times when the albacore catch is the largest.

It may be of interest to note here that the experimental fishing done by this Commission some time ago demonstrated the fact that by the use of long lines the albacore may be taken at times when they are not feeding at the surface and consequently cannot be taken by surface fishing methods such as the use of short hand lines and the "Jap pole method." The blue-fin tuna also takes the long line and hooks quite freely.

UNITED STATES BUREAU OF FISHERIES, SAN PEDRO LABORATORY.

The work of the United States Bureau of Fisheries Preservation Laboratory at San Pedro is being temporarily continued by the Fish and Game Commission until funds can be obtained by the Bureau. There is hope that the bureau will get an appropriation which will enable it to continue the laboratory from the first of January and to reimburse the state for what it has spent; although this last, while possible, is hardly probable. The bureau continues virtually to direct the work although the state, in order to get due credit, appears as the operator and will publish the preliminary reports of the work. The Commission entered into this arrangement believing that by so doing it would aid in the expansion of our fisheries and would prevent the almost total loss of the laboratory's preceding year's work. It was believed that by so doing the fish canners of the state would be pleased and all others interested in the wellfare and development of the fishing industry.

In helping to this extent there was the desire to aid a federal bureau which stands for the development and conservation of the fisheries as does no other bureau—a bureau which for many years has carried on fisheries conservation work in this state and which it is hoped will continue to carry on in the future.

The laboratory, a year ago, undertook fish canning experiments which for good and sufficient reasons were scheduled to continue over a period of two years before their completion. It was necessary to continue this work for the bureau in order to tide it over a temporary financial depression and thus preserve to the state the bureau's well-equipped laboratory and the bureau's inclination to continue this valuable line of research work. If we had not done so the years' work would have been lost as well as the $20,000 already expended.

The United States Bureau of Chemistry has established a laboratory at San Diego for work similar to that which is being done in the preservation laboratory of the United States Bureau of Fisheries at San Pedro. There is plenty of work for both laboratories and each should receive encouragement. The Commission is doing all it can to prevent duplication of work by the two bureaus and to bring about a correlation of their activities. Mr. Almy, who will supervise the work of the laboratory of the Bureau of Chemistry, and Dr. Alsburg, head of the bureau, have assured the Commission that they desire to cooperate to a sufficient extent to avoid unnecessary duplication of work.

OCTOPUS FISHING IN JAPAN.

Recently several octopi were brought into the San Francisco markets which had been caught by the local rockcod fishermen on rockcod gear. In a recent visit from Dr. Kamakichi Kishinouye of the Tokyo Imperial University, Japan, some very interesting information concerning the methods used in fishing for octopus in Japan was gained.

One method used is as follows: Long lines are let down to which are attached earthenware pots or vases of the right size to accommodate the octopus for which they are fishing—we should judge these pots would average $1\frac{1}{2}$ to $2\frac{1}{2}$ feet deep and from 8 to 14 inches in diameter. Some of these pots are suspended with the mouth down, others suspended with the mouth up from the long horizontal line. Each pot has a small hole in the bottom to let the water easily escape when the pots are raised. The pots are not baited, and since it is the habit of the octopus to find a hiding place in the rocks, they crawl into the mouth of the pot and remain there until they are pulled out. The pots are set one day and pulled the next; one boat will handle about 200 pots. Ordinarily buoy floats are not used to locate the lines but they are picked up with a grappling hook, for it is believed that the floating buoy disturbs the pots and prevents the octopus from entering.

They are also caught by means of hook and line. In this method the fisherman baits the hooks, several of them on a long line, and when they have lowered them until they come in contact with rocks, they continually jerk the lines. The octopus, in feeding, reaches out its arms to get the bait with its sucking discs and the jerking of the hooks catches the arms or tentacles.

SILVER SALMON AT MONTEREY IN 1920.

Since the last two seasons in California have shown relatively poor catches of king or Chinook salmon there is an increased interest among fishermen and packers in the other possible species of salmon that might serve to fill in the breach, especially during bad years. The most abundant of the lesser species is the silver salmon, a fish of lower oil content than the king and therefore less desirable for canning, although it sells readily on the fresh markets. Along our northern coast it forms a large per cent of the salmon catch. The southern boundary of commercial salmon fishing (Monterey) seems to be almost out of the range of the silver salmon. The salmon investigation now being conducted by the Commission has gathered some information as to the relative abundance of the two principal species and from time to time further notes on their occurance, seasons, abundance and worth on the markets will be published.

In a recent number of *California Fish and Game* (Oct. 1919) it was noted that the silver salmon in 1919 did not appear at Monterey, just for a few days, but that they were caught in small numbers over a period of eleven weeks with a heavy catch on four or five days during the period. Detailed notes were kept in the 1920 season's run in Monterey Bay and it was found that the appearance of silver salmon in small numbers extended over a longer period this year and that they were not caught in great numbers during any four or five consecutive days as was true in 1919. At no time this year did they outnumber the king salmon. In 1919 the first silver salmon was noted on May 10, while in 1920 the first was caught on April 19. During the remainder of April, 1920, a few were caught each day averaging between four and five pounds apiece. For instance, on April 23, the silvers made up 4.4 per cent of the catch in number of fish and 1.6 per cent in weight, the rest of the catch being kings. During May there were very few silvers caught at Monterey, but on June 1, they formed about one-fifth of the catch. On June 2, the silvers were 18 per cent in number and 8.2 per cent in weight of the catch and averaged a little less than 7 pounds apiece. June 3, and 4, the silver catch was somewhat less and from the fifth to thirteenth of June there were only a few silvers caught. On June 14, the silvers picked up to 15.3 per cent in number of fish and 7.7 per cent in weight in the catch. By June 17 they were 24.2 per cent in number and 17.5 per cent in weight in the catch and averaged 7.8 pounds each. From June 18 to 21, the silvers averaged about 7.9 pounds but the per cent in the catch dropped off. On June 22, the silvers in the catch were 19 per cent in number of fish and 8.8 per cent in weight with an average weight of $7\frac{1}{2}$ pounds and the average weight dropped to 7 pounds for the following week. By this time the king salmon season was about over so that the silver salmon caught, although few in number, formed a relatively higher proportion of the catch. For example, on June 24, the silvers in the catch were 33 per cent in number and 22.8 per cent by weight. June 25, the per cent of silvers dropped to 18 and from then on for the remainder of the season there was only an occasional silver salmon caught.

W. L. S.

OCEAN AND STREAM SALMON CATCHES.

Frequently the question is raised as to the relative importance of trolling and stream netting for salmon in California so that a summary of the figures of total salmon catch may be of general interest. The 1920 figures are not yet complete. The following figures, in round numbers, represent yearly total salmon catch of the state in pounds of fish in the round.

	River caught.	Ocean caught.	Season total.
1919	5,987,000	7,158,000	13,145,000
1918	7,173,000	5,920,000	13,093,000
1917	5,493,000	5,563,000	11,056,000
1916	5,342,000	5,501,000	10,843,000

There are three chief trolling regions: (1) Shelter Cove, (2) vicinity of San Francisco, (3) Monterey Bay. The two chief netting regions are the Sacramento river and the northern coast streams such as the Eel, Klamath, and Smith rivers. The 1919 salmon catches for these regions expressed in percentage of the total catch of the state are as follows:

Region.	Per cent	
Ocean—		
Shelter Cove	22	
San Francisco	11	
Monterey Bay	22	55
Stream—		
Sacramento River	35	
Northern Rivers	10	45
	100	100

The salmon caught at Monterey, outside San Francisco, and in the Sacramento River are generally classed together as a unit since it is assumed that they result from spawning in the Sacramento. At present a possible restriction of the trolling and netting of salmon is being discussed. A contrast in the catch by these two methods is shown by the following table of catch in round numbers of pounds:

	Mont. Bay.	Outside S. F.	Troll fish.	(Taken with nets) Sac. River.
1919	2,816,000	1,443,000	4,259,000	4,529,000
1918	2,893,000	1,929,000	4,822,000	5,938,000
1917	3,880,000	1,280,000	5,160,000	3,971,000
1916	5,231,000	263,000	5,494,000	3,451,000

There are changes from year to year in the importance of the salmon fishery of any one locality. For example, the catch at Monterey has dropped off while the Noyo-Shelter Cove catch has been steadily increasing due to the recent development of the industry at those northern trolling points. In 1917 the total from the Noyo-Shelter Cove region was less than a half million pounds, in 1918 over one million and in 1919 only a little less than three million pounds. A minor item of interest is that each year a few salmon are caught by trolling and netting along the coast of the southern counties far to the south of Monterey. Last year 10 pounds were reported, in 1918 one thousand and in 1917, 2000 pounds. W. L. S.

THE SALMON SEASON AT MONTEREY.

The Monterey salmon season of 1920 was even poorer than last year. The catch is roughly estimated at one-fourth of the normal or about one-half of last year's catch. In round numbers the Monterey catch (exclusive of Santa Cruz) was 1,290,000 pounds, this year as opposed to 2,316,000 pounds in 1919. The early season's catch this year was better than a year ago, but there was not the customary large run during the latter half of May and the first two or three weeks of June. The season practically ended in June, but there was a small catch on two or three days near the end of July. The local trolling fleet was about quadrupled by the addition of boats from northern points, but the poor catch was so discouraging that many fishermen returned to San Francisco during the middle of the season.

In spite of the fact that each year has seen a steadily increasing number of boats trolling for salmon in Monterey Bay, the yearly catch has been dropping off, as shown by the following figures, in round numbers, of pounds of salmon caught in the bay.

1919.	1918.	1917.	1916.
2,816,000	2,893,000	3,879,000	5,231,000

As stated above, the 1920 catch is little more than half that of 1919.

W. L. S.

NOTES FROM THE STATE FISHERIES LABORATORY.*

WILL F. THOMPSON, Editor.

THE FISHERIES LABORATORY AND ITS WORK.

At the time these notes go to the editor, considerable progress has been made toward the establishment of a permanent laboratory building for our work. The most encouraging advance in that direction has been the granting by the city of Los Angeles to the Fish and Game Commission of a long-term lease to a site at Fish Harbor, San Pedro. It is situated at the intersection of Seaside avenue and Tuna street, and will be most accessible to all canners and fishermen who may be interested.

A description of the site and the discussion of the plans for the building, of which rough sketches are at hand, may await the time when the plans are in finished condition, but it will be well to state now as clearly as possible those ideals to which the Commission is planning to dedicate a unique institution. Such a statement may save misunderstanding and opposition, and should give to those interested an appreciation of the underlying purposes such as will enable them to comprehend the reasons for the choice of site and for the plans adopted. The site was chosen because of its proximity to the canneries and the fish wharves, making it possible to follow easily the progress of the fishery. The plans adopted are intended to give good working room for a statistical and biological study of the fisheries for the purpose of conservation and adequate utilization and at the same time to allow an exhibit to those interested of the purposes of the work and its relation to the fisheries.

That the primary purposes of the investigations of the California Fish and Game Commission are conservation and adequate utilization has been stated many times. But such purposes have been repeatedly avowed by investigators, whose programs when adopted have betrayed a primary interest in general natural history, and have shown little relationship to the problems to be solved. The scientific program of the Commission has, however, been planned very specifically to meet the problems which are involved in governmental control of the fisheries, and are adapted to meet the responsibilities of the state as legal guardian of those natural resources. The machinery for the execution of this program is, in fact, already operating in part, and its purposes are stated very clearly in the laws of the state as duties of the Commission. Section 1 of the particular law referred to is as follows:

> "It shall be the duty of the Fish and Game Commission to gather data of the commercial fisheries and to prepare the data so as to show the real abundance of the most important commercial fishes; to make such investigations of the biology of the various species of fish as will guide in the collection and preparation of the statistical information necessary to determine evidence of overfishing; to make such investigations as will bring to light as soon as possible those evidences of overfishing as are shown by changes in the age groups of any variety of fish; to determine what measures may be advisable to conserve any fishery, or to enlarge and assist any fishery where that may be done without danger to the supply."

The law then goes on to make provisions for the statistical system now in use as one of the bases for the scientific work. This system is to the best of our knowledge one without parallel in any country, and it has already proved itself superior to any statistical system we are acquainted with. It registers the catch of every boat, leaving its record for subsequent study by scientists in conjunction with other records by which changes in apparatus and economic conditions may be discounted, in order that there may be obtained a measure of the fluctuations in abundance of fish from year to year. It will be inevitable, in the future, that any scientific program carried on by the possessors of such complete records as by this law we shall eventually have, will be a program designed to discover the meaning of such records in terms of abundance and scarcity of fish. That there are faults in the system must be granted, but the faults are infinitesimal compared to those of statistical systems depending upon estimates and hearsay. The laboratory will provide for the filing and the study of these records.

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*California State Fisheries Laboratory, Contribution No. 21.

But this statistical work is only a part of the program, and in formulating both this and the biological, which is in a way the more important, the Commission has had before it the several programs adopted during the last two decades in other countries, notably in those bordering the North Sea and our North Pacific, and from these programs and their results it has been possible to decide within somewhat narrow limits what knowledge is necessary to competently legislate for our fisheries. The failures and successes of others during the recent great advances in fishery science have profited us. And in this fact is seen the reason why the program for the proposed laboratory will be a really vital one, *dealing with questions which actually face the legislator and the men interested commercially*. It will lack the vagueness of random natural history investigations, and it will avoid the limitation in value of technological research. In the future we may justifiably hope that the investigations carried on in the new laboratory will further define and clarify the many problems to be met with.

And in thus reviewing the work in other fields perhaps the most obvious fact has been the absolute necessity of access to the vast store of specimens and data to be furnished by the commercial fisheries. No agency could afford to duplicate this store, despite its vital importance to any investigations. And this has, in fact, determined the location of the laboratory and dominated in the construction of its plans. Another obvious conclusion to be drawn from the work of others has been the necessity of obtaining popular support by exhibiting to those interested the purposes of the work, and its achievements, as well as by showing graphically the necessity for it. Because of this there has been planned an exhibit room.

The great scientific value of this work may not be immediately obvious to the scientist who is interested in some of the more basic laws of biology. It may appear too practical. Yet this definition of aim, and practical trend actually heightens the value of the work from the standpoint of general science. The problems faced by the legislator are, in striking degree, the same as those in which the student of geographical distribution, and of evolution is or should be interested, and the material offered by the commercial fisheries far exceeds in extent that which can be obtained through other sources. The degree of isolation of different races and the extent to which it leaves its traces on the morphology or habits of the species is of great importance to one pondering the value of protection to a species overfished in a particular locality, just as it is to the man interested in the formation of races and species. The rapidity of growth, the distribution of pelagic ova or larvæ by currents, the response of the species to changes in surrounding conditions, all affect both the conclusions of the naturalist and those to whom the apparent abundance of fish is vitally important. Above all, however, our program will be most vital to the progress of hydrographical science in its relation to the food supply of man, through what is in reality the most essential purpose of our work—the measurement of the actual abundance of fish in the ocean. The effect of hydrographical conditions on fish can not be measured without a knowledge of the real abundance of fish, of the rate of growth, and the habits. So, in addition to being dedicated to the service of competent legislation for conservation and utilization, the laboratory will be in a very real way an essential part in the progress of more general scientific knowledge.

W. F. T.

PROGRESS OF THE ALBACORE WORK.

During the past summer Mr. Thompson has been pursuing in so far as possible the study of the albacore, with particular reference to its age and rate of growth. Mr. Rich and Mr. Sette have been stationed since June at San Diego and San Pedro for the purpose of collecting for Mr. Thompson certain measurements and statistics bearing on the various problems.

The study of the age has progressed to a point where the results are being prepared for publication. The age marks on the scales being illegible save in part, a special technique was necessary in order to decipher them. This was the more necessary in that serious questions have arisen in some quarters regarding the accuracy and care with which age readings have been made in the cases of other species—and indeed, well-known biologists have openly challenged the fact that scales and otoliths actually do show age. The work on the age of the albacore has demonstrated clearly and unmistakably the absolute correspondence of the actual age of the fish and the marks on the scales by a method entirely free from the influence of the worker's personal judgment. Painstaking and time-consuming as the work has been, it has proved entirely worth while, and is the first direct knowledge we have of the age of any of the species of the mackerel family on this coast.

These results show the albacore to be a fast growing species, with all that implies regarding the effect of commercial fisheries upon it. Their discussion must await the final publication. But attention may be called to the fact that with their aid conclusions have been tentatively reached regarding the migration of the albacore. It is believed that the species shows a gradual migration to the northward through a period of years, but that the migration of any one year class is in general limited. The seasonal migrations are the most prominent and striking.

The summer's work has also continued to add to our material bearing on the migrations and the fluctuations in the run of fish and on the relationship of catch to temperature or some allied factor, thereby placing certain facts beyond dispute. These can not be treated very fully here, and it is hoped that as soon as the work on the age is out of the way, attention may be turned to these data, which will, it is believed, prove highly interesting. The data at hand are exceedingly extensive, perhaps more so than the data available for any other fishery, as the records for the whole industry from its beginning have been collected. The results are already well defined, but remain to be placed in shape for publication.

It will be recalled that we have analyzed the relative abundance of fish during past years (see Pacific Fisherman Year Book, 1919) and found a steady fall in the catch of the same unit of gear from year to year. We ventured to say, however, that this fall was not, judging from various things, due to depletion, and the events of this summer have reassured us in this regard. The catch has shown an increase and the reappearance of younger classes of fish, both encouraging signs. The possibility that overfishing may occur is not, however, eliminated.

W. F. T.

PROGRESS OF THE CLAM WORK.

Since April, 1919, F. W. Weymouth has been devoting a portion of his time to the completion of a survey of the shellfish of the California coast commenced several years previously by Will F. Thompson. A report is now ready for the press embodying all the collected data. The primary purpose of the survey has been to put on record the number and abundance of the species of commercial importance and the location and condition of the beds at present being utilized. The scope of the report has been extended by the inclusion of descriptions and figures, together with a key for ready identification of some forty species of present or possible commercial value. Heretofore no such key has been available, and it is hoped that by this publication, campers and amateur clam diggers can be made acquainted with the edible bivalves of the coast. Besides the description and range of each species an account of its habits has been included. Though many collections of attractive and interesting "shells" have been made, there are few observations on the varied habits of these animals and it is hoped that those recorded in this report may lead to more study of the remarkable ways in which the bivalves are adapted to the diverse conditions of life under which they are found.

In connection with this survey certain important points have developed. One is the need for a more detailed study of the life history of at least some of the more representative and important species. At present, though several of the eastern species have been carefully investigated, no facts concerning the age or rate of growth of a single native Pacific species are known.

In an attempt to remedy this lack, data have been collected throughout the year on the Pismo clam, one of the most important California species, and these are now being carefully studied. The preliminary work indicates the main features of the age and as soon as it can be completed it will be put in form for publication. It appears that the growth is less rapid than has been supposed and that a considerable age is reached by the larger specimens met with.

A careful survey of the coast has forced the conclusion that few of the native species can be materially increased by artificial means, but that in certain suitable bays the "farming" of the introduced soft shell or long clam might be made very profitable. Its culture has passed the experimental state on the eastern coast and profiting by this experience many acres of otherwise barren tide flats might be made to yield as sure and valuable a crop as a wheat field. It is hoped that in the future the question of the control of suitable tide lands may be put on as secure a basis as is the management of existing oyster lands, thus making such clam farming a practical possibility.

F. W. W.

PROGRESS OF THE SARDINE WORK.

The investigation of the sardine fishery is being continued along lines laid down in previous publications in this magazine (Volume 6, No. 1, pp. 10-12), and in Fish Bulletin No. 2. Mr. Elmer Higgins has, during the past season, been made responsible for the carrying out of the program at San Pedro, while Mr. O. E. Sette has been, until this last June, responsible for the same at Monterey, both under the direction of Mr. W. F. Thompson for the present. Mr. Sette, who is leaving this fall for a resumption of his college work, will continue his sardine work while at college. The principal attention of both of these workers has been concentrated on the discovery of the rate of growth through a study of the frequency of occurence of various sizes of fish, and the following of fluctuations in average size, sex, maturity, quality, etc., during the fishing season. In view of the importance of the sardine industry, somewhat more attention is given to an exposition of this work than is the case with the other fisheries with which we are dealing.

The program under which the work has been done contemplates (1) the discovery of depletion if it should occur; (2) the discovery of any great natural fluctuations in abundance or quality other than those due to overfishing; (3) the foretelling of these fluctuations, which in other fisheries have at times caused great damage; (4) the deciphering of those habits of the species which are of importance to the canner and fisherman, such as migration, and (5) a knowledge of such facts as will aid the legislator. The absolute completion of this program is without doubt well removed, but contributions to it of great value will be made in the very near future, enabling us to make at least provisional answers, a thing impossible now. Among these we may list the age and rate of growth, the breeding season, and the degree of independence of the sardines in different regions. That the foretelling of fluctuations is not visionary may be seen from the work of the Norwegian fishery authorities on the herring. The other elements of the outline given are dependent entirely upon the records we obtain—and we are acquiring the very best possible.

A certain amount of preliminary work had been done by Mr. W. F. Thompson, assisted by A. W. Warnock and others before the inauguration of the present investigations a year ago. In this preliminary work the breeding season had been observed at San Pedro (as mentioned by Mr. Higgins below), a series of scales collected for the study of the age, and a set of careful observations made on the differences between the sardines from San Diego, San Pedro and Monterey. The latter observations, as bearing on the possibility of the interdependence of the sardines in different regions, have been completed by Mr. Higgins in addition to his own work and reports on the conclusions may be expected in the near future.

PRESENT STATUS OF THE SARDINE INVESTIGATION IN THE SAN PEDRO DISTRICT.

In the study of the sardine fishery, as distinct from that of the fish itself, the course of the run at San Pedro—the abundance or availability of the fish from day to day throughout the season—has been studied by analysis of the daily average boat catch. This was determined by tabulating and averaging the individual catches of each boat day by day, the data being obtained from the filed carbon copies of the original fish receipts issued by the canners to the fishermen at the time of delivery. This tabulation and analysis of the average boat catch, including the records of some 110 boats, is in course of completion. Careful consideration, however, has been given such artificial factors as market or labor conditions in arriving at a conclusion as to the daily abundance of the species and an effort has been made to take them into account.

The character of the season's run has been studied by taking a twenty-pound sample of the fish from the individual boat loads day by day at the time of unloading at the canneries, together with data on the locality and time of the catch. To date, 182 such samples have been taken from boats unloading at seven canneries in San Pedro and Wilmington, and from them the average weight, average length of the fish in each boat load, the size or age groups represented, sex and degree of sexual maturity, were determined. From these samples about 5000 individual fish have been specially measured and sexed. And from these data the spawning habits, the class of fish taken, and the variation in the catch have been studied. The degree of mixing of age or size groups, or the degree of uniformity of size in different schools is also being investigated.

The measurements of the large series of fish above mentioned, in addition to indicating the character of the run, have been tabulated to show the frequency with which fish of each length occur. This tabulation of length-frequency is the oldest reliable method of determining the age of fishes (see *California Fish and Game*, Vol. 5, No. 2, p. 53), and the curves or graphs prepared from our figures give undoubted indications of the ages of the various sizes of commercial importance.

The study of the maturity and spawning habits of the sardine at San Pedro was begun two years ago when Mr. Thompson and assistants made series of examinations of the condition of the roe during the spring of 1918 and 1919. The results of these observations were published in this magazine in July 1919.* The same observations were repeated during the past spring season by the writer and in addition to the records of spent and relatively mature fish, the roe of about 140 fish was preserved at weekly intervals and deposited in the laboratory collections for future microscopical study. The records of the maturity obtained while measuring the large series of fish mentioned above have also been tabulated and curves drawn to show both the relative numbers of immature, relatively mature, and spent fish present in each size group, and also the per cent of mature fish at each length.

The same series of measurements has been studied to determine the relative numbers and sizes of the two sexes, in regard to possible selective migrations, relative mortality, and differences in rate of growth. E. H.

THE SARDINE PROBLEM IN THE MONTEREY BAY DISTRICT.

That the Monterey sardine fishery has increased in volume to eight times that of three years ago is evidence enough that the possibility of depletion can not be much longer ignored. The value of the present annual pack, about five and half million dollars, warrants the concentration of attention on this problem. Consequently, in the summer of 1919 the work was commenced.

The investigation was begun November 12, 1919, and was carried on energetically to the end of the season in March, 1920. The work was necessarily of the nature of a preliminary survey and involved the taking of extensive daily records of the various aspects of the daily commercial catch. Samples from about six boat loads were taken daily as the fish were unloaded at the canneries. An average weight of sardines in the respective catches was ascertained by the weight and count of the fish in these representative samples, the locality of the catch was obtained in most cases by a personal interview with each fisherman, and a number of fish were reserved from each sample for further examination. This remaining work was done at Hopkins Marine Station, where the Fish and Game Commission was courteously granted the use of quarters and facilities. This made possible the taking of accurate measurements of the sardines and a dissection for the purposes of determining sex and the development of spawn in the fish. During the season 345 samples were taken, 7534 fish were measured and sexed, and about 200 ovaries were preserved for study of the egg development.

A partial analysis of this data shows

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*California Fish and Game, Vol. 5, No. 3, p. 159, July, 1919.

that we have definite clues to the answers of the vital questions, and it but remains for a more extended study to corroborate and substantiate facts which we have concerning the age, rate of growth, migration and spawning. A complete report of findings will be published by the fisheries research laboratory at an early date.

Of course large questions of yearly fluctuations in abundance and sizes, with their important bearing on depletion, can not be comprehended in the results of one season's data, but the data taken this last season are invaluable as the first of a series of consistently comparable scientific observations of each season's catch, without which nothing concerning depletion can be detected before the harm is already done. It now remains for continuance of this study to solve all of the problems concerned, and insure the perpetuity of our great resource, through the adoption of intelligent conservational measures. O. E. S.

LARGE TUNA.

A large proportion of the blue-fin tuna caught during the month of August this year was of unusually large size. A six-ton load of excessively large ones was brought in to San Pedro by the boat "Little Perina" on August 16. The fish averaged 113 pounds, the largest tuna weighing 182 pounds and measuring five and a half feet in length, and the smallest measuring over four and a half feet in length. The average weight of tuna, and the size most convenient to handle, varies around 30 or 40 pounds. The fishermen complain of much damage to their nets by the large tuna, the meshes not being strong enough to withstand the assaults of these monsters. O. E. S.

LIFE HISTORY NOTES.

BAND-TAILED PIGEON NESTS IN SEQUOIA NATIONAL FOREST.

On September 1, 1920, Guard Arnold and myself, while working on the head waters of Deer Creek, Section 35, T. 23 S., R. 31 E., M. D. M., at an elevation of approximately 6500 feet, discovered the nest of a band-tailed pigeon, *Columba fasciata fasciata.*

The nest consisted of a few small dry fir limbs and twigs about 10 feet from the ground in a dogwood tree. The nest was so rudimentary that it did not seem possible that it could be a nest at all. On it was one small squab about one-fourth the size of the parent bird. It was naked except for a few sparse reddish-brown hairs on the head and back. We saw eight adult birds near where we found the nest and they acted as if they had nests near by. W. F. DERBY.

LARGE MACKINAW CAUGHT IN DONNER LAKE.

On July 10, 1920, Mr. J. C. Purdy of Sacramento, California, caught a fifteen-and-a-half-pound mackinaw trout in Donner Lake. This large fish was caught with a trolling tackle. The mackinaw trout was first planted in Lake Tahoe in 1895 and a year later in Donner and other nearby lakes after the successful hatching of a shipment of eggs. Although fish of this species are occasionally caught in lakes of the Truckee Basin, the mackinaw, or Great Lakes trout as it is sometimes called, has never thrived to the extent expected when introduced into this part of the country.

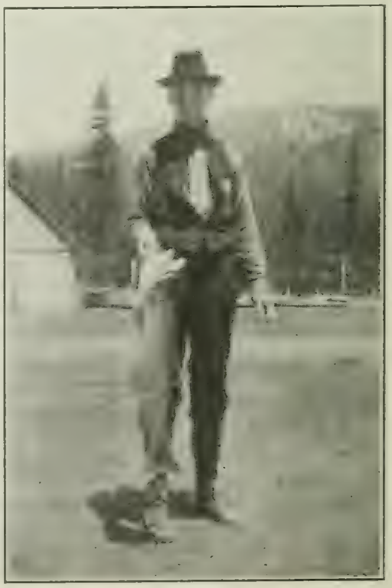

FIG. 47. Mackinaw trout caught by J. C. Purdy, in Donner Lake, Truckee, California.

SPARROWS DESTROY GARDENS.

The damage to fruit by the house finch and the damage to fall and winter gardens of the city and suburbs and some country districts by the intermediate sparrow are responsible for most of the bad feeling which some people hereabouts have for "birds." Owing to the flocking and cover-loving habits of this sparrow the damage to gardens is confined to those near which the birds find ready cover. For example, a garden in the open or even a hundred feet from a hedge or brushy canyon is perfectly safe. Plots that suffer are little home gardens in the thinly settled parts of city and country.

The vegetables eaten are lettuce, peas, string beans, turnips, radishes, beets, the things planted here from October to April when this sparrow is one of our most abundant birds. Onions are untouched, and I believe carrots also, and potatoes very seldom if other stuff is present; besides the potato grows too fast to be greatly damaged. But where the birds have congregated they will practically clean up small gardens of growing tender vegetables. Trapping is of no avail, owing to their numbers. Screens of wire or cloth are effective but people dislike the trouble and expense. Often they give up in despair until April. Frightening birds away with clods only drives them to a friendlier place. The only solution of the problem I know is to plant after October 1 what the birds will not eat and cover up other tender things until April. CARROLL DEWILTON SCOTT.

REPORTS.

STATEMENT OF EXPENDITURES.

For the Period from July 1, 1919, to June 30, 1920.

Administration:		
Commissioners	$1,672 70	
Executive offices	26,217 67	
Printing	3,824 84	
Research and publicity	5,030 44	
Accident and death benefits	2,765 19	
		$39,510 84
Commercial fish culture and conservation:		
Superintendence	$13,639 99	
Inspection and patrol	29,693 55	
Research	18,122 68	
Statistics	9,662 74	
Market fishing license commissions	765 00	
Propagation and distribution of salmon	22,703 34	
		94,587 30
Sporting fish culture and conservation:		
Superintendence	$14,510 34	
Printing	1,909 94	
Prosecutions and allowances	655 05	
Angling license commissions	15,324 20	
Special field investigation	252 35	
Fish exhibits	7,208 91	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	34,545 05	
Los Angeles District (40 per cent)	14,148 00	
Sacramento District (40 per cent)	27,303 76	
Propagation and distribution of trout	121,102 29	
		236,960 89
Game conservation:		
Printing	$3,879 17	
Prosecutions and allowances	1,225 38	
Hunting license commissions	21,131 20	
Mountain lion hunting and bounties	6,950 23	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	51,580 75	
Los Angeles District (60 per cent)	21,222 05	
Sacramento district (60 per cent)	40,956 68	
		146,945 46
Tahoe camping ground		3,152 98
Total expenditures		$521,157 47

CALIFORNIA FRESH FISHERY PRODUCTS, APRIL, MAY AND JUNE, 1920.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican
Albacore												391,103		513,018		904,121	
Anchovies			3,093					119,160	150	12,350				16,060		150,813	
Barracuda								97			912	2,258,943	27,783	601,753		2,889,488	21,604
Bocaccio		15						21,677	13,615	233,745						269,052	
Bonito												7,718	10	1,538		9,266	
Carp				7,121	22,621		7,615	2,524								39,881	
Catfish		5,019		14,963	21,110		15,905									56,997	
Chilipepper								24,784	70,875	525						96,184	
Cultus cod	699	12,383						50,757	17,055	12,777		13				93,684	
Flounders				6,401			552	263,997	13,675	530	2,141	989	4			288,289	
Grayfish							395	7,250		70		19,565		272,635		299,915	
Hake								37,025	500							37,525	
Halibut	6,951	11,799	760					12,363	579	3,539	97,272	398,093	43,006	407,290		981,592	122,689
Hardhead					1,380											1,380	
Herring			810													810	
Kingfish								6,538	40,360	77,125	259	35,936	216	447		160,881	
Mackerel									812	38,227	519	852,693	7,442	79,373		979,066	515
Mullet														55		55	
Perch	3,432		12,710				9	10,840	3,331	7,222	1,520	5,876	170	625		45,735	
Pike				630	779		292									1,701	
Pompano								1,214	1,218	679		5,681		27		8,819	
Rock bass											340	37,404	3,502	19,342		60,588	210
Rockfish	2,742	3,555						146,870	81,439	97,312	22,818	145,470	4,515	151,061		658,782	170
Sablefish								135,960	5,446	12,212						153,618	
Salmon	27,002	626,951	4,098	447,699	117,996	77,880	400,696	21,765	167,794	1,098,533						2,989,814	
Sanddabs								210,651	38,969	4,750		2,463				286,776	
Sardines			113					5,550	625	1,597,662		3,566,582		3,611,229		8,781,761	
Sculpin												12,208	63	665		12,936	
Sea bass (black)											495	5,117	200	21,975		27,787	550
Sea bass (white)								213	521	177	20,353	777,062	1,964	124,641		924,931	9,845
Sea trout								187				8,901	250	615		9,953	
Shad			100	748	72		6,968	28,795	142	104						36,929	
Shad (buck)				174,571	24,028		206,666	1,075								406,340	
Shad (roe)				287,555	39,253		539,680	1,398								867,886	
Sheepshead												63		1,088		1,151	
Skates								15,647	1,250			600	22			17,519	

Skipjack																	10,844
Smelt	17,710		7,961				3,551	29,888	18,757	10,792	17,208	21,167	6,203	509		133,746	
Sole	25							680,160	156,150	9,663	6,129	6,257	83	550		859,017	
Splittail					544											544	
Striped bass			780	97,214	27,059		101,092	67,253	40							296,438	
Stingaree			120,300	170										170,817		291,287	
Suckers					593											593	
Surf fish												10				10	
Swordfish												163				163	273
Tomcod								8,782								8,782	
Trout (steelhead)	10															10	
Tuna												17,062		4,109		21,171	10,844
Tuna (bluefin)												4,340				4,340	
Tuna (yellowfin)												310				310	487,119
Turbot			13													13	
Whitebait			10					58						60		128	
Whitefish												6				6	
Yellowtail												548,766	37	73,512		622,315	20,890
Miscellaneous				205			55	13,713	3,385	1,271	385	10,910	1,661	1,260		32,845	
Total fish	58,571	659,722	150,688	1,023,677	258,435	77,880	1,286,476	1,959,194	669,718	3,186,265	170,351	9,141,411	97,131	6,074,254	---	21,823,773	685,553
Crustaceans—																	
Crabs (doz.)	1,032		166					11,682	259	9						13,148	
Shrimps								250,910				99				251,009	
Spiny lobsters																	320,743
Mollusks—																	
Abalones	180							35		165,324	59,729					225,268	1,509
Clams (cockle)	403	80	2,214								100		2,870			5,751	
Clams (mixed)	2,760		13,645					204					465			17,014	7,057
Clams (Pismo)											79,370					79,370	
Clams (soft-shell)	44	3,899	2,050				40,475	1,857								48,325	
Cuttlefish								12,146	1,343	3,297		375				20,161	
Limpets													10,500			10,500	
Mussels		510					1,871				78		13,575			15,981	
Oysters:																	
Eastern (No.)			161,325					913,400								1,074,735	
Native			26,380													26,380	
Squid									145	93,281		280				93,706	
Miscellaneous—																	
Terrapins (doz.)				6												6	
Turtles																	38,399
Scallops													230			230	

All amounts shown in pounds unless otherwise specified.

VIOLATIONS OF FISH AND GAME LAWS

April 1 to June 30, 1920.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	7	$125 00
Trapping without license	3	35 00
Deer—close season—killing or possession	20	805 00
Female deer—spike bucks—fawns—killing or possession	3	100 00
Illegal deer hides—possession	3	700 00
Brush and cottontail rabbits—closed season—killing or possession	5	125 00
Quail—in captivity without permit	2	100 00
Doves—closed season—killing or possession	7	175 00
Ducks—closed season—killing or possession	3	75 00
Nongame birds—killing or possession	5	35 00
Protected shore birds—killing or possession	1	25 00
Pheasant—killing or possession	1	----------
Possession condor wings	1	10 00
Total game violations	61	$2,310 00
Fish.		
Angling without license	27	$600 00
Fishing for profit without license	13	120 00
Striped bass—underweight—excess limit and offering for sale—closed season	6	190 00
Black bass—closed season—taking or possession	7	260 00
Sunfish—closed season—taking or possession	3	60 00
Perch—excess limit—taking or possession	1	20 00
Trout—excess limit—closed season—taking other than by hook and line	7	100 00
Clams—undersized—excess limit	7	175 00
Crabs—undersized—excess limit	13	70 00
Abalones—under or oversized—closed season	45	1,400 00
Shrimps—dried—possession	5	100 00
Fishing in restricted waters	4	50 00
Illegal fishing apparatus	10	750 00
Pollution of state waters	1	----------
Total fish violations	149	$3,895 00
Grand total fish and game violations	210	$6,205 00

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS.

April 1 to June 30, 1920.

Game.	
Deer meat	243½ pounds
Doves	8
Rabbits	1
Miscellaneous game	1
Deer hides	3
Deer heads	1

Fish.	
Sturgeon	210½ pounds
Trout	27 pounds
Black bass	25½ pounds
Striped bass	189¾ pounds
Barracuda	2,100 pounds
Halibut	1,300 pounds
Salmon	14 pounds
Dried shrimps	1,000 pounds
Crabs	617
Abalones	780
Clams (Pismo)	369
Clams (cockle)	606 pounds
Illegal nets (including 26 fyke nets)	34
Crawfish traps	10

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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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THREE CALIFORNIA MARKED SALMON RECOVERED.

By J. O. SNYDER, Stanford University.

Three marked king salmon were secured last summer by W. L. Scofield, who was engaged in making obeservations for the Fish and Game Commission. Each of the three specimens had the adipose and left ventral fins excised. The mutilations were of such a nature that they could not be attributed to any other causes than the methods used in marking small fish. One was taken at Monterey, April 6. It measured 73 centimeters. Along with others it was evicerated before anything unusual was noticed regarding the fins. The sex, therefore, could not be determined with certainty. The second was caught at Shelter Cove and brought to Fort Bragg, August 17. It was a male, which measured 71 centimeters and weighed 8¼ pounds. The third was caught in the Sacramento River near Pittsburg. It, too, was a male and measured 68 centimeters. These three fish are the first captured from some marked ones liberated in the Sacramento River in 1918.

Mr. W. H. Shebley writes concerning these fish: "The eggs were collected during the fall of 1916 at the Bureau of Fisheries stations on the Sacramento River. The resulting fry were put in Sisson Lake in the spring of 1917 and held until October of the same year. They were then placed in the small rearing ponds at Mount Shasta hatchery. The fry were marked during November and December, 1917. These to the number of 18,000 were distributed in Cold Creek, a tributary of the Sacramento River, on March 19, 1918."

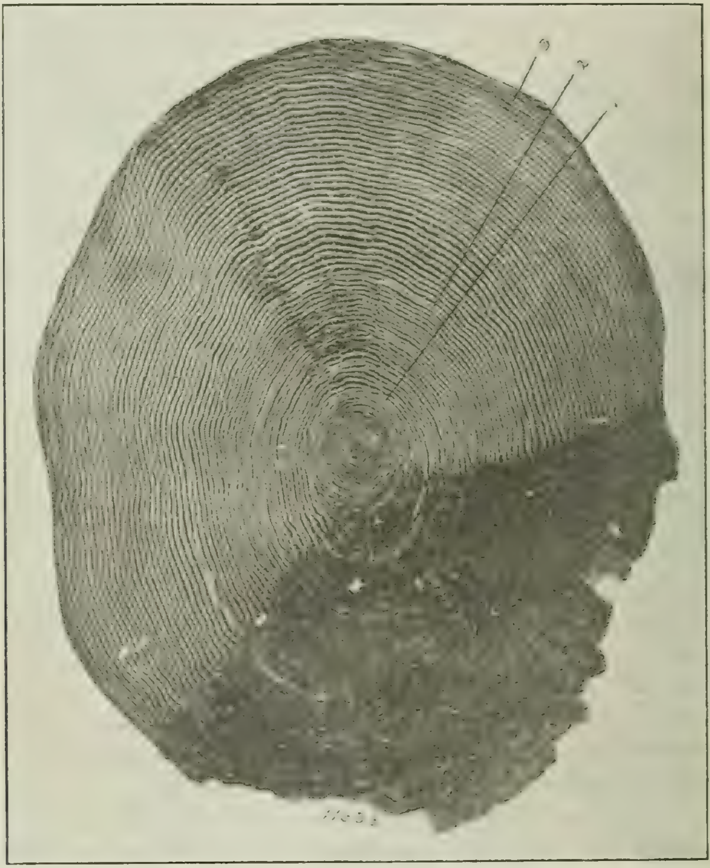

FIG. 1. Photomicrograph of scale of salmon marked at the Mount Shasta Hatchery in 1917 and taken at Monterey, April 6, 1920. Length 73 centimeters. Numerals mark the end of the first, second and third years of growth.

A photomicrograph of a scale from each of these fish is presented. It will be seen at a glance that the Pittsburg specimen differs markedly from the others in that the edges are frayed or worn. This frayed appearance of the scales was characteristic of all fish observed at the time, and it plainly indicates that the absorption of reserve tissues was already in progress, a condition just preceding the breeding period. The fish from which this scale was taken was very dark in color, and the snout had become elongated and hooked.

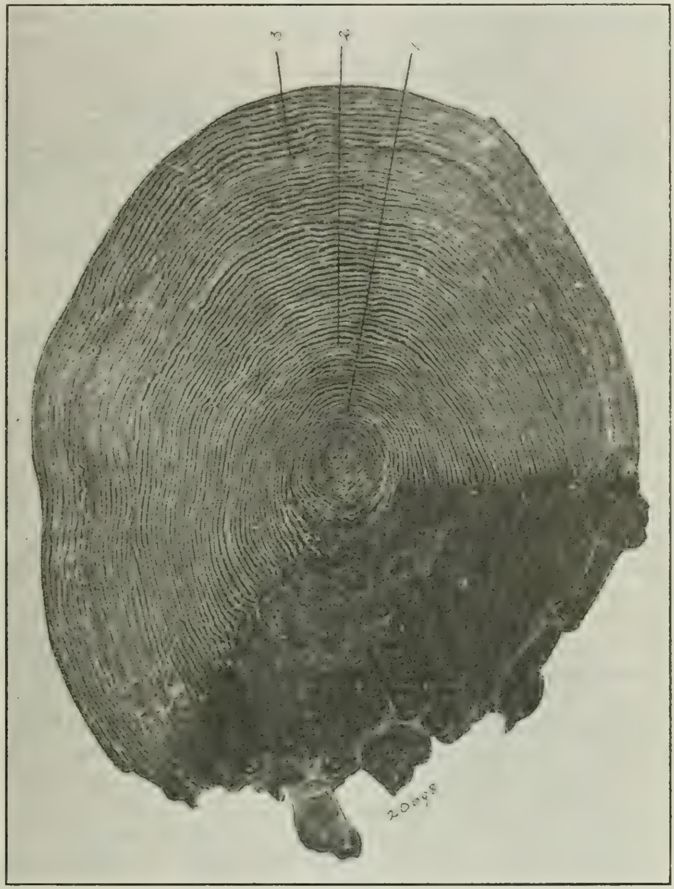

FIG. 2. Photomicrograph of scale of salmon marked at the Mount Shasta Hatchery in 1917 and taken in Shelter Cove, near Fort Bragg, on August 7, 1920. Sex, male; length 71 centimeters; weight 8¼ pounds. Numerals mark the end of the first, second and third years of growth.

A nuclear area of closely apposed rings appears near the center of each scale. This area corresponds with the period in the fish's life spent in fresh water, including the lake, pond and river. The nuclear area is surrounded by alternating bands of broad and narrow rings representing times of rapid or slower growth, which may be interpreted in periods of years, the second year growth ending at 2, the third at 3, while the fourth is in progress. The rapid growth of the fourth year was early interrupted in the case of the Monterey fish, while allowed to progress farther in the Shelter Cove and Pittsburg examples.

The most valuable information coming to us with the capture of these marked fish is that the sea range of Sacramento salmon not only embraces Monterey Bay to the southward, but that it extends far northward as well. Now there is urgently desired at the present time some definite information regarding the source of supply of the marine salmon fisheries, and we have here a very plain suggestion as to the procedure necessary to gain at least some of that information. To be sure, it is perfectly well known that these salmon breed in certain large streams, but it is not known whether California streams alone contribute to our ocean supply, or whether we are in a measure reaping a harvest from seed sown north of our boundaries. The opinion has been freely expressed in some quarters that the salmon of Monterey Bay are from the Sacramento River, that those from Fort Bragg and Shelter Cove are from streams entering the ocean north of these localities, and in short, that young salmon on migrating into the ocean progress southward from their place of entry, where they live and grow until the approach of maturity. With a firm belief in the theory of southward migration, some fishermen and others of experience will even pretend to identify Columbia River salmon among those caught near Fort Bragg. We have at present very little to show that their belief is not well founded, but they have still less to demonstrate that it is. The capture of this marked Sacramento River fish at Shelter Cove, a long distance north of the mouth of the river, is then easily seen to be a matter of considerable importance. The evidence derived from a single example should not be overestimated, however, and it seems evident that only investigation involving carefully planned experiments will be of definite aid here and elsewhere in a profitable study of the life history of the salmon. It is very probable that such investigation might be carried on to better advantage in a stream much smaller than the Sacramento, for when one comes to consider the difficulties of obtaining results from a marking experiment, for example, in a very large river with the wide distribution and varied character of its fisheries, it is really remarkable that even three fish from a considerable number were secured. Moreover, the question as to whether some of our smaller streams may be made to contribute with profit to sea fishing is well worth considering, for the present rapid growth of irrigation and power projects, which seriously interfere with the natural breeding grounds of salmon in the Sacramento and Klamath rivers, foreshadows the time when some attention will be directed elsewhere if we seriously care to maintain our supply of these fish.

There is one point of interest connected with these scales to which, however, one is not as yet warranted in attaching any real significance. It will be observed that in the Shelter Cove scale, and particularly in that from the Sacramento River, the annual checks are very marked, while in the Monterey specimen they are much less distinct. A comparison of a large number of scales from the region of Fort Bragg and Shelter Cove, with many from Monterey Bay, seems to give the impression that the presence of sharply defined annual checks is not very characteristic of scales of Monterey salmon, but that, in contrast with those from the region of Fort Bragg, they are much less pronounced and in many cases difficult to detect. Although one is not prepared to even speculate as to the reason for this, especially since the cause of the growth check is not known, it is, at any rate, of passing interest to observe that in the character of the growth check both the Monterey and Shelter Cove scales conform to what appears to be the fashion in each locality. And if appearances are not misleading, one would be tempted to suspect that the Sacramento fish had spent its sea life in the region of Fort Bragg or Shelter Cove. Furthermore, if we calculate the length attained by each fish at the end of the second and third years, which may be done with some degree of accuracy from measurements obtained from the scales, it will be seen that the Shelter Cove and Pittsburg specimens agree in being smaller than the one from Monterey.

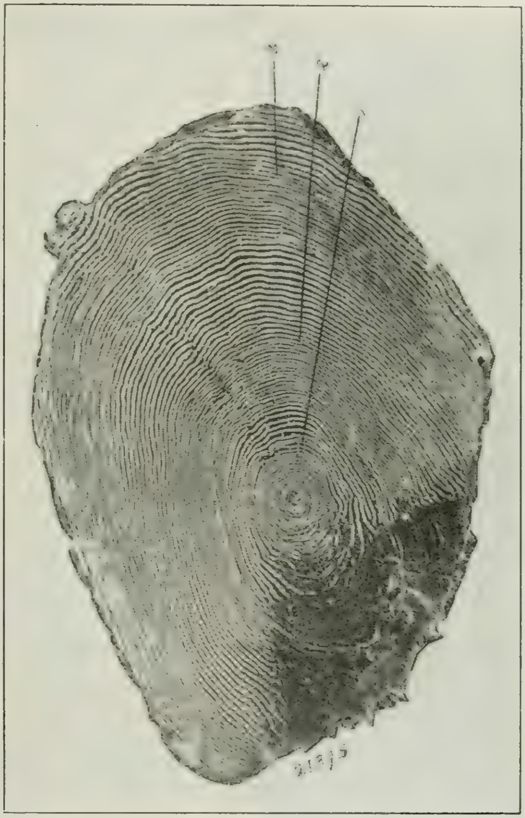

FIG. 3. Photomicrograph of scale of salmon marked at the Mount Shasta Hatchery in 1917 and taken in the Sacramento River at Pittsburg, September 15, 1920. Sex, male; length 68 centimeters. Numerals mark the end of the first, second and third years of growth.

Monterey ---------second year 30 centimeters; third year 71 centimeters
Pittsburg ---------second year 27 centimeters; third year 55 centimeters
Shelter Cove ------second year 22 centimeters; third year 59 centimeters

This may be only a matter of coincidence, but interest will not be lost after a comparison of a number of fish from Fort Bragg and Monterey. From the scales of a hundred fish caught in Monterey Bay, and which had apparently entered the sea as yearlings, the average length at the end of the second and third years was computed. The same was done with a like number of similar fish from the vicinity of Fort Bragg. In both cases the specimens were taken at random as they appeared in the catch. The result was as follows:

Monterey ---------second year 38 centimeters ; third year 65 centimeters
Fort Bragg -------second year 35 centimeters ; third year 59 centimeters

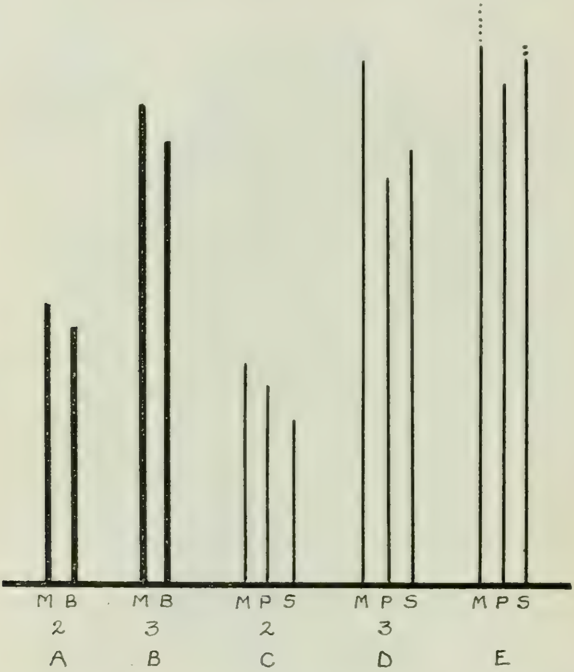

FIG. 4. Diagram showing the average length of marked and unmarked salmon, at two and three years of age, taken at various places.

A simple diagram will serve well to show these comparisons. A and B represent the average lengths at 2 and 3 years, M being the fish from Monterey, and B representing those from Fort Bragg, including Shelter Cove. C and D are the lengths of the marked fish from Monterey, Pittsburg and Shelter Cove at the end of second and third years. E represents the lengths of these fish at time of capture, the dotted tips indicating that growth was interrupted by capture before maturity.

Judging from the experience of investigators who have experimented with the marking of salmon, we may expect to see more of these fish in the fifth year. Their capture will be awaited with interest.

AN INSTANCE OF ADULT, SEA-RUN CHINOOK SALMON FOUND FEEDING IN FRESH WATER.*

By WILLIS H. RICH, Field Assistant, United States Bureau of Fisheries

During the course of the writer's investigation of the salmon of the Columbia River, it was learned, through apparently reliable sources, that the chinook salmon which entered the Cowlitz River during the early spring were feeding upon the smelt or euchalon (*Thaleichthys pacificus*) which run in large numbers at this time of year.

The Cowlitz River empties into the Columbia River nearly seventy miles above the mouth of the latter — well above the highest reach of brackish water. It is well known that the habit of adult salmon, entering streams for the purpose of spawning, is to cease feeding at least as soon as the fresh water is entered. In many cases the fish apparently cease to feed as soon as they leave the open ocean and definitely begin the journey to the spawning grounds even though the first part of the journey may be through pure, or nearly pure sea water. This is true of the Fraser River sockeyes which enter Puget Sound through the Strait of Juan de Fuca and which cease to feed as soon as the journey through the strait has begun.† The mature salmon taken just within the mouth of the Columbia River have ceased feeding although the water is only slightly fresher than sea water. Numerous other examples illustrating the same point might be cited. In view of these facts, the feeding of salmon so far from the ocean as the Cowlitz River formed a remarkable contradiction to the usual habit and it seemed desirable to fully investigate the report. On account of the spring closed season no commercial fishing for salmon was being carried on at the time the smelt were the most plentiful and it was necessary to make special efforts to secure specimens. On April 14, 1916, in company with a fisherman and one of the state fish wardens, several drifts with a gill net were made in the Cowlitz River

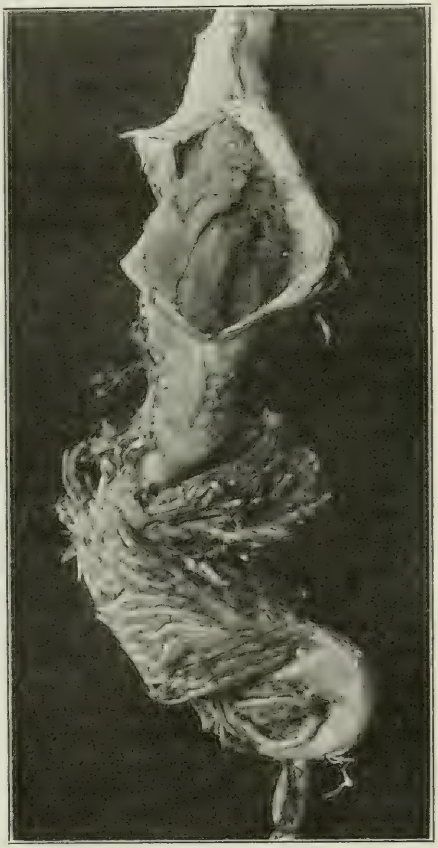

FIG. 5. Stomach of an adult sea-run Chinook salmon found feeding in the Cowlitz River, Washington. As a rule the stomach of a salmon found in fresh water shows no evidences of its being in use.

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*Published by permission of the U. S. Commissioner of Fisheries.

†This is described by Gilbert in his paper on The Salmon of Swiftsure Bank, Report of the Commissioner of Fisheries, Province of British Columbia, 1912 (1913), page 116.

just below the town of Kelso. One chinook was finally secured—a female weighing about 25 pounds. The examination fully confirmed the reports, as the stomach contained upward of a dozen smelt in various stages of digestion. The stomach, partially dissected in order to expose the contents, is shown on the previous page.

This unusual habit is without doubt occasioned by and associated with the presence of enormous numbers of smelt. These smelt enter the Cowlitz and a few other tributaries of the Columbia River for the purpose of spawning and, at the height of the season, are gathered in close schools in small restricted localities. The laying of the eggs is apparently accomplished while they are thus aggregated. Evidently these conditions as found in the Cowlitz, where large numbers of small fish are closely schooled, approximate the normal feeding conditions as found in the ocean. Similar habits of the salmon will doubtless be found in other streams which have runs of smelt or other small anadromous fishes coinciding with a run of chinook salmon. Other species of salmon may also have a similar habit. It is probable that the salmon have followed the smelt run in from the ocean and that they continued to feed while passing up the main river and into the Cowlitz. This seems more likely than the alternative, that they had ceased feeding on leaving the ocean but began again on entering the Cowlitz.

In this connection it should be noted that the precocious male salmon which have matured after spending the first year in fresh water continue to feed even after the sex products have ripened. Such precociously mature males are commonly found both among wild fish and among those which have been reared in hatchery ponds. In certain instances it has been noted that these mature yearlings have recovered from the effects of maturity and have survived—contrary to the rule in the case of sea-run adults.*

It would seem that this is chiefly on account of the fact that the normal food supply has been constantly present so that it has not been necessary for the fish to cease feeding during the spawning period. The fact that adult, sea-run salmon will frequently take the hook when well into fresh water is further evidence that the normal feeding reaction is not disturbed merely by the entrance into fresh water. At many places chinook salmon may be taken by trolling with large spoon hooks. The salmon fishing at the Oregon City Falls on the Willamette River is well known. The steelhead fishing on other western streams, particularly the Rogue River, has a wide spread reputation, as has also the fishing for Atlantic salmon in Maine and Canada. In many cases these fish are taken hundreds of miles above the mouth of the streams.

It may be concluded from these observations that one of the factors which cause salmon on entering a stream for the purpose of spawning to cease feeding is the lack of a normal food supply. In the particular instance herein described, a normal food supply was present, with the result that the fish fed in a normal manner. It is possible that a longer residence in fresh water or the nearer approach of the spawning season would cause the fish to cease feeding even though a normal food supply was available.

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* Early History and Seaward Migration of Chinook Salmon in the Columbia and Sacramento Rivers. By Willis H. Rich. Bulletin of the Bureau of Fisheries, XXXVII, 1919–20. Doc. 887, page 67.

STEELHEADS CAUGHT AT SEA OFF THE COAST NEAR FORT BRAGG.

By J. O. SNYDER, Stanford University.

Trollers fishing for salmon off the coast north of San Francisco have reported the capture of steelhead trout at sea. None of these trout has been available for study until this summer, when W. L. Scofield, while making observations for the Fish and Game Commission at Noyo River near Fort Bragg, was fortunate enough to separate 16 specimens from the mass of king and silver salmon brought in there. Material was preserved so that no doubt is involved in the identification of these fishes. From the collector's notes the following paragraph is taken:

The first steelheads appeared July 23, and the last one was seen August 25. On August 14 five specimens were found, and again on August 16 the same number were secured. In color they were of the characteristic steel blue above and bright silvery on the sides; the dark upper surface with small blackish spots, numerous on some examples, less abundant on others; the head with few or no spots. The dorsal, adipose and caudal fins were spotted, the size and number of spots varying considerably in different individuals. The pectoral and ventral fins were immaculate except for dark anterior margins. the lateral series of scales as recorded from twelve individuals number from 132 to 143, the count being made to base of caudal fin; the series from lateral line to back 25 to 34. They measured 19 to 29 inches, and weighed 2¾ to 9¾ pounds. There were eleven males.

FIG. 6. Noyo Estuary, showing salmon fishing boats. Photograph by J. O. Snyder, 1920.

These fishes are regarded as examples of *Salmo irideus*, the rainbow trout. This identification is based on what appears to the writer as a well-founded assumption, that but two species of trout* inhabit the costal region of California. *S. irideus* and *Salmo clarkii*, the cutthroat trout, sea living individuals of both being known as steelheads.

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* Bureau of Fisheries Document No. 638, page 183.

The steelheads enter the rivers to spawn, their progeny in turn migrating to sea where food is plentiful, or remaining for an indefinite time in fresh water as the case may be, the latter being recognized as stream trout. The rainbow trout is a large scaled form, there being about 110 to 150 series of scales on the body, while the cutthroat has smaller scales, about 150 to 200 series. In their distribution the two species overlap, both occurring in the coastal streams from Redwood Creek northward.

In spite of the fact that these steelhead trout have been known for many years and that they are of considerable economic importance, our store of carefully observed and recorded facts concerning them is very meager. Some observations have lately been made on the Klamath, in which river both species enter from the sea and migrate for spawning purposes. Here there are two fairly distinct migrations of steelheads, one occurring in the winter, the other in the summer. Of the winter run we know very little; nothing, in fact, of what species it is composed. The summer run consists almost entirely of *S. irideus*, an example of *S. clarkii* occasionally appearing. The latter may be spoken of as one among thousands in the migration of the former. In the summer of 1919* the first steelheads were taken in salmon nets on July 11; the largest number were caught about August 27, and the run had about ceased October 22. The progress of the steelhead migration coincided in general with that of the king salmon, not only in its rise and decline, but in its periodical irregu-

Fig. 7. Noyo Estuary, showing canneries. Photograph by J. O. Snyder, 1920.

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* Agents of the Fish and Game Commission have been making observations on the trout and salmon for two summers in the estuary of Klamath River. Through the kindly interest of Mr. G. R. Field, they have been enabled to examine thousands of individuals, which his fishermen have taken.

larities as well, a large wave of steelheads being generally associated with a similarly large wave of salmon.

As these steelheads appear fresh from the ocean, many still bearing living salt water crustacea attached to their bodies, they are of a beautiful deep steel blue above, with highly burnished silvery sides. They have usually very definite black spots on the head and body, they are always present on the dorsal, adipose and caudal fins, while the remaining fins are immaculate. Sometimes the head is without spots and the body has very few. Counts on a number of examples resulted as follows: Head spots, 0 to 25; body, 8 to 271; dorsal fin, 47 to 98; adipose, 1 to 9; caudal, 14 to 220. The spots of the head are almost always round; those of the body elongate or linear. The ova found in these fishes are very small, their undeveloped condition giving rise to the suggestion that the steelheads have entered upon a very long migration or at least a considerable period in fresh water. Their stomachs are mostly empty, and they remain so at least while they are in the estuary for the very simple reason that there is not food enough in the river to supply such a horde, were its members inclined to eat. They occasionally strike a spinner, but they will not rise to fly, nor are they often attracted to a baited hook. Later in the season and farther up stream their appetites are said to return, and their behavior is governed accordingly. About the middle of August, steelheads that have begun to assume their nuptial colors are occasionally seen in the estuary. The cheeks become tinted with pink, and a broad reddish blush appears along the sides. At the same time the dark dorsal area loses its marine hue and becomes light olive. No salt water crustacea are found attached to these tinted individuals, and it appears probable that they have been in fresh water for some time. The steelheads fresh from the sea are plump, fat and full of energy. At times they have been seen in numbers leaping high from the water and falling with a resounding splash, in strong contrast to the salmon which only cut the surface with their backs and tails.

The largest steelhead caught in the Klamath is said to have weighed 32 pounds. Those which appear from day to day are much smaller. For example, on August 13 and 14 of this year, 248 specimens that were caught in gill nets measured 14½ to 32 inches and weighed 1⅛ to 14⅜ pounds. The entire lot gave an average weight of 5.86 pounds; 10,862 examples showed an average weight of 4.3 pounds. Small fishes are not apt to become entangled in the coarse meshes of the drifting gill nets, and it is therefore of interest to find that a fine meshed seine will bring from the river not only large specimens but smaller ones as well, individuals 8 or 10 inches in length having been taken which exhibit every detail of color possessed by the larger steelhead fresh from the sea. Whether these small fishes have just come in from the ocean we are unable at present to say.

The scales of these Klamath steelheads which are identified as *Salmo irideus*, rainbow trout, number 116 to 150 in the lateral series. The steelhead trout taken at sea near Fort Bragg are of the same species as those that enter the Klamath in the summer in such large numbers. They may even be Klamath trout for all that we know, but it seems more reasonable to assume that their parent stream is somewhere nearer their place of capture.

THE RELATIVE MATURITY OF THE CHINOOK SALMON TAKEN IN THE OCEAN ALONG THE PACIFIC COAST.*

By WILLIS H. RICH, Field Assistant United States Bureau of Fisheries.

This paper is in the nature of a preliminary report dealing with the maturity of the chinook salmon taken by troll and purse-seine in the ocean along the Pacific coast, and is presented for the purpose of making immediately available some of the results of the investigation. It is also believed that the method used for determining the relative maturity is new and may be of value to others engaged in similar investigations. A later report will give in detail the data upon which the conclusions presented in this paper are based, and will discuss several topics treated very briefly, or omitted entirely from this paper.

The amount of trolling and purse-seining for chinook salmon along the Pacific coast has increased enormously during the past few years, especially along the northern coast of California, the coast of Oregon, and off the mouth of the Columbia River. To anyone who has observed even casually the fish thus taken in the ocean it is perfectly apparent that a great proportion are immature and it is a point of considerable interest and practical importance to know just what percentage are immature and the relative degree of immaturity. The determination of the age by means of scale studies will not, alone, give a sufficient index to the degree of immaturity since there is such a wide range in the age at which these fish reach the spawning stage—from two to six years. If the percentages of individuals of different ages among the mature fish were constant, it would be possible, from a determination of the percentages of fish of different ages taken by troll and purse-seine in the ocean, to estimate the percentage of fish of different degrees of maturity. This, however, is not the case. The percentages of fish of the various age-groups vary greatly at different times among the mature fish and also among those taken in the ocean. Presumably these variations are due quite largely to racial differences but our present knowledge of the various races of chinook salmon is quite too limited to aid in segregating the races from mixed lots. Even if our knowledge of the races were complete it might well be that they could not be identified and segregated accurately and fully enough to serve the purpose. It is apparent that some other means than the determination of the age is necessary in order to learn the percentages of mature and immature fish taken in the ocean and their relative maturity.

The method which has been developed for determining the relative maturity is based upon variations in the size of the eggs. Obviously this can be applied only to the females and no method has yet been devised for determining the relative maturity of the males. The percentages of males and females found among the mature fish of the various age groups will give some basis for estimating the percentages of mature and immature males from the determination of the relative maturity of the females, but a discussion of this topic must be reserved

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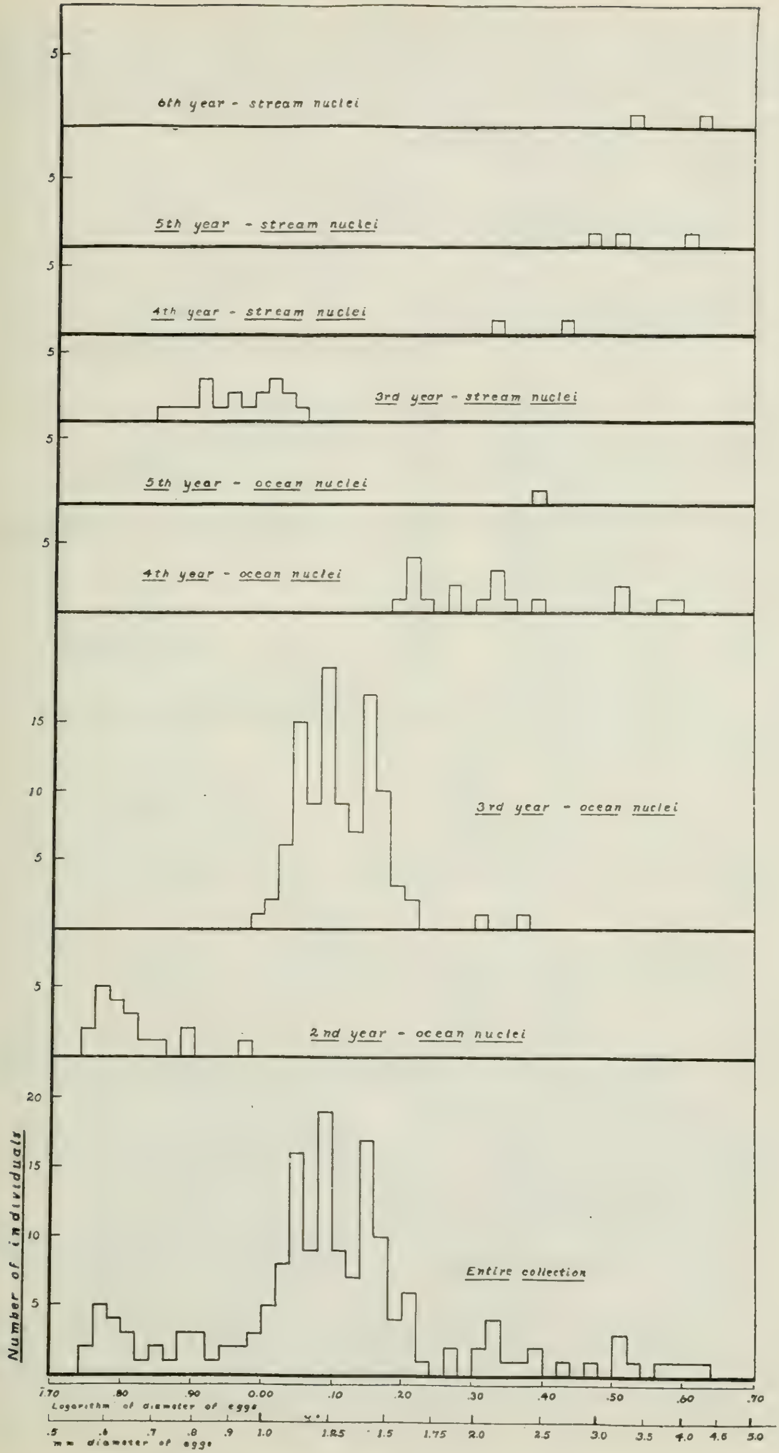

FIG. 8. Histogram showing frequency-distribution of 163 female salmon taken by troll off the mouth of the Columbia River, May 8, 1919, based on the logarithms of the diameters of the eggs.

for the complete report. It is sufficient to state here that, while there is a tendency for the males to mature somewhat younger than the females, the error which would result from assuming that the proportions of fish of similar degrees of maturity were equal in the males and females would not be serious.

Superficial examination of the eggs found in the females taken in the ocean shows that there is a wide diversity in the size and, further, that several more or less distinct size-groups are distinguishable even without careful measurement. It is a natural assumption that these various sizes of the eggs indicate different degrees of maturity. A careful study of several collections of fish taken within the Columbia River and by troll off the mouth of the Columbia, in Monterey Bay, California, and along the northern coast of California confirms this assumption and shows that, by means of a study of the variation in the size of the eggs and a determination of the age by means of the scales it is possible to distinguish, with certainty, in many cases, and with reasonable probability in most, between fish which would have spawned during the year in which they were taken and those which would not have spawned for at least one more year. The distinction between fish which would not have spawned for two years is not quite as definite but in some collections the interpretation is clear.

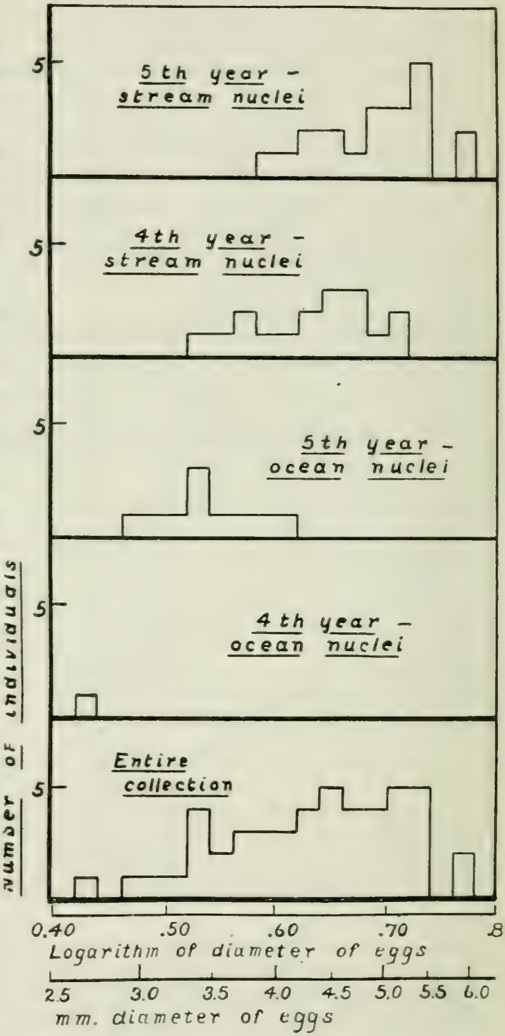

Fig. 9. Histogram showing frequency-distribution of 48 females taken by beach seines and wheels near Warrendale, Oregon, June 16, 1919, based on the logarithms of the diameters of the eggs.

In studying these collections the age has been determined by the usual method of scale study. The size of the eggs has been determined by measuring ten of each sample and taking the average. The larger eggs—those over 1 mm. in diameter—were measured in a simple device which consists essentially of a small trough, V-shaped in cross-section and with closed ends, which is graduated in millimeters. In use this is partially filled with water, the eggs are placed in a row in the bottom of the trough, and then are carefully pushed up to the zero end of the scale by means of a small piece which fits the bottom of the trough and on which is graduated a vernier enabling one to read accurately to tenths of a millimeter. The measurement of ten eggs by this scale

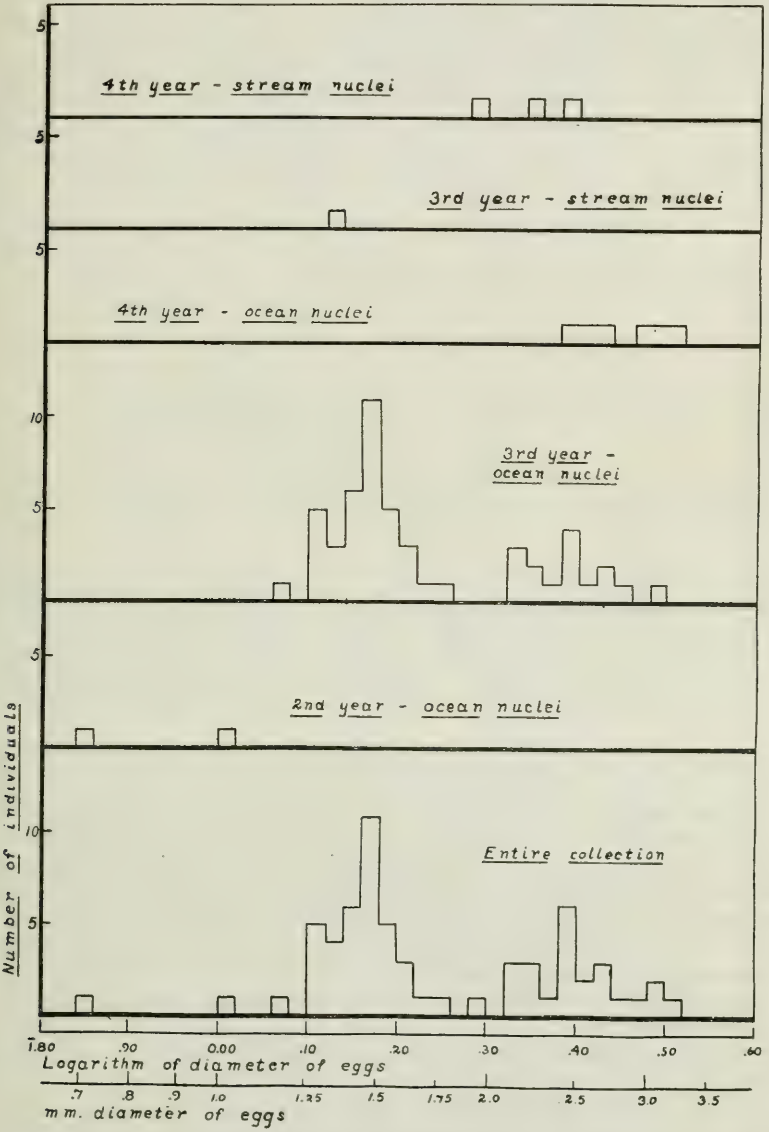

FIG. 10. Histogram showing frequency-distribution of 63 females taken by troll in Monterey Bay, California, June 19–21, 1918, based on the logarithms of the diameters of the eggs.

gives directly, by simply moving the decimal point one place to the left, the average size of the eggs to hundredths of a millimeter. As a matter of fact this measurement is finer than is necessary in the great majority of cases. In preparing eggs for this measurement it is necessary to free them very carefully from the ovarian membranes so as not to break the delicate shell and yet to clear them of all shreds of tissue which might tend to affect the measurement. The smaller eggs—those less than 1 mm. in diameter—were measured by means of a microscope fitted with an eyepiece micrometer carefully standardized. In using this method it was necessary, of course, to measure the ten eggs separately and then the average of these measurements was found.

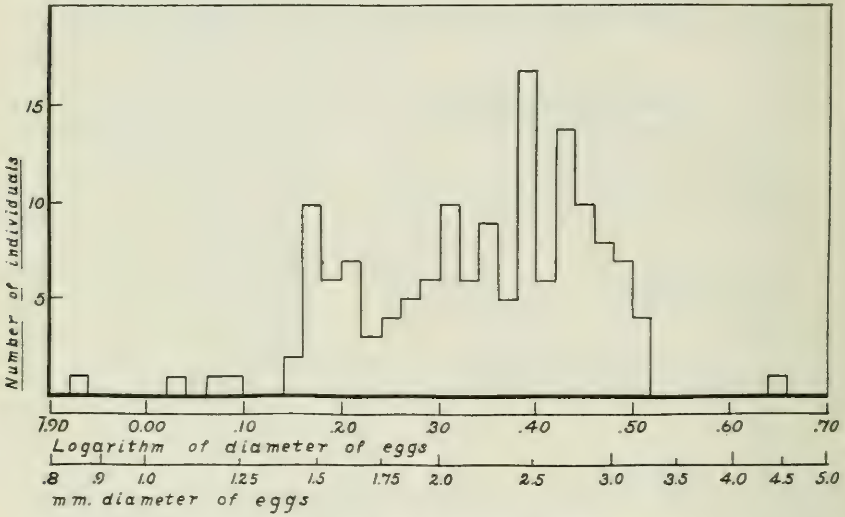

FIG. 11. Histogram showing frequency-distribution of 144 females taken by troll in Monterey Bay, June 29, 1915, based on the logarithms of the diameters of the eggs.

The tabulating and plotting of these egg measurements has been done on a logarithmic basis—that is, the logarithms of the actual measurements have been tabulated rather than the measurements themselves. The main advantage of this sort of tabulation lies in the fact that proportional variations in size are equally shown independent of the actual size, and it is the relative size of the eggs, rather than the actual diameter, which is significant.[1]

In preparing the tables and charts the classes have been arranged with intervals of .02 in the logarithm of the diameter of the eggs. This signifies that the mid-value of each class is 4.713 per cent greater than that of the class next preceding.

The following collections have been used in the preparation of this preliminary report:

1. 163 females taken by troll off the mouth of the Columbia River, May 8, 1919.
2. 68 females taken by troll off the mouth of the Columbia River, June 4, 1919.
3. 48 females taken by beach seines in the Columbia River near Warrendale, Oregon, June 16, 1919. (Warrendale is approximately 150 miles above the mouth of the river.)

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[1] The writer is indebted to Prof. F. W. Weymouth of Stanford University for an acquaintance with this method of tabulating.

4. 48 females taken by traps in Baker Bay, Columbia River, July 3, 1919. (Baker Bay and Sand Island, where the next collection was taken, are both just within the mouth of the river.)

5. 41 females taken by beach seines on Sand Island, Columbia River, July 6, 1919.

6. 101 females taken by troll off the mouth of the Columbia River during August 13 to 17 and September 16 to 17, 1918. (But five of these were taken in September and these have been considered with the August collections.)

7. 95 females taken by troll off the mouth of the Columbia River, August 13, 1919.

8. 63 females taken by troll in Monterey Bay, California, June 19 to 21, 1918.

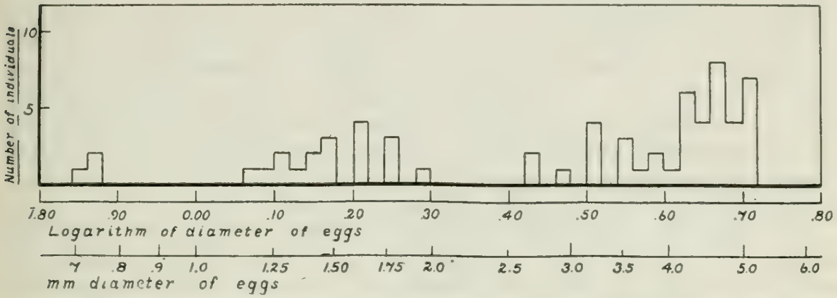


FIG. 12. Histogram showing frequency-distribution of 64 females taken by troll near Drake's Bay and Fort Bragg, California, July and August, 1918, based on the logarithms of the diameters of the eggs.

Full data including scales were taken with each of the above collections. In addition to these the following two collections consisting of eggs alone were studied:

9. Eggs from 144 females taken by troll in Monterey Bay, June 29, 1915.

10. Eggs from 64 females taken by troll near Drake's Bay, August 15 and 16, 1918, and Fort Bragg, July 17, 1918, on the coast of northern California. Scales and data were also collected from the females at the same time the collections of egg samples were made, but the records were not kept so that the egg samples could be referred to the corresponding data and scales. It has been necessary, therefore, to treat egg samples and other data independently.

It will be impossible, in this report, to give in detail the evidence necessary to prove the validity of this method for determining the relative maturity. The graphs will, however, give illustrations of typical results obtained from the measurement and tabulation of the eggs. An examination of the graphs shows that, in the collection of undoubtedly mature fish from Warrendale, the eggs were fairly uniform in size, ranging from about 2.5 to 6 mm. in diameter. The obvious graduation in size of the eggs in the different age-groups is probably significant of racial differences, but a discussion of this point cannot be given in this paper. In the case of the fish taken by troll in the ocean the frequency-distribution based on egg sizes shows a distinct grouping around several modes which are usually quite well separated.

Three modes are especially distinct and, in the case of the collections for which age determinations were also made, and which have, therefore, been separated into the component age-groups (Monterey, 1919, and Columbia River, May, 1919) it is apparent that the group characterized by the largest eggs (above 2 mm. in diameter) is composed chiefly of fish in their third, fourth and fifth years, whose scales show the ocean type of nucleus, and of fish in their fourth and fifth years whose scales show the stream type of nucleus. [The nuclear growth here referred to is that located close to the center of the scales and represents the portion of the scales formed during the first year. The "stream" type indicates that the fish remained in the stream during the entire first year of its life. The "ocean" type of nuclei indicate that the fish have migrated seaward sometime during the first year, usually early.]

The group representing the next smaller size of eggs (1.25 to 1.5 mm.) in diameter is characterized especially by fish in their third year with either ocean or stream nuclei, while the group representing the smallest eggs (.6 to .8 mm.) is characterized chiefly by fish in their second year with ocean nuclei. The size of the eggs in the group having the largest eggs corresponds, in each instance, with the size of eggs in the Warrendale collection and are, therefore, without doubt fish which would have matured during the year in which they were taken.

It is apparent, then, that in general the group characterized by the largest eggs is composed of fish one year older than those composing the group with eggs of the next smaller size, and that these in turn are one year older than those composing the group with the smallest eggs. These differences in the size of the eggs are not dependent on corresponding differences in the size of the fish. There is, indeed, a distinct correlation between the size of the fish and the size of the eggs, but, as will be shown in the more detailed report, this correlation is by no means ample and is unquestionably modified by the approach of maturity. Of particular interest and significance is the presence of two groups of individuals within the same age-group which may be definitely separated on the basis of egg sizes. This is shown with unusual clearness in the third year fish with ocean nuclei taken at Monterey in 1918. The group with eggs greater than 2 mm. would undoubtedly have spawned during the fall of the same year in which they were taken, while the fish composing the other group would not have spawned for at least one more year. These facts which have been so briefly and incompletely discussed seem to fully justify the conclusion that the size of the eggs is a fairly reliable index of the relative degree of maturity of chinook salmon.

Without attempting to discuss further the method used for determining relative maturity, a tabular summary will be given of the results obtained by the study of the ten collections which have formed the basis for this report. It is hoped that further study will increase the accuracy of the results, and it seems probable that some of the percentages given in the table may be somewhat modified by additional investigations. It is believed, however, that the results as given here are fairly reliable. In preparing the table care has been taken to include doubtful cases always with the more mature of the two groups to which they might be assigned. This has been done in order not to exaggerate the degree of immaturity exhibited by any of the various collections.

TABLE I.

Composition as to age groups and relative maturity of a collection of 165 females taken by troll off the mouth of the Columbia River, May 8 to 10, 1919.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 2d year	--------	--------	--------	--------	19	100	19	11.5
In 3d year	2	2	100	98	--------	--------	102	61.8
In 4th year	18	100	--------	--------	--------	--------	18	10.9
In 5th year	1	100	--------	--------	--------	--------	1	.6
Stream nuclei—								
In 3d year	--------	--------	18	100	--------	--------	18	10.9
In 4th year	2	100	--------	--------	--------	--------	2	1.2
In 5th year	3	100	--------	--------	--------	--------	3	1.8
In 6th year	2	100	--------	--------	--------	--------	2	1.2
Totals	28	17	118	71.5	19	11.5	165	--------

TABLE II.

Composition as to age groups and relative maturity of a collection of 68 females taken by troll off the mouth of the Columbia River, June 4, 1918.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 2d year	--------	--------	--------	--------	18	100	18	26.5
In 3d year	--------	--------	32	97	1	3	33	48.5
In 4th year	--------	--------	1	100	--------	--------	1	1.5
In 5th year	1	100	--------	--------	--------	--------	1	1.5
Stream nuclei—								
In 3d year	--------	--------	10	100	--------	--------	10	14.7
In 4th year	2	50	2	50	--------	--------	4	5.8
In 5th year	--------	--------	1	100	--------	--------	1	1.5
Totals	3	4	46	68	19	28	68	--------

TABLE III.

Composition as to age groups and relative maturity of a collection of 48 females taken by seines and wheels near Warrendale, Oregon, June 16 and 17, 1919.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 4th year	1	100	--------	--------	--------	--------	1	2
In 5th year	10	100	--------	--------	--------	--------	10	21
Stream nuclei—								
In 4th year	17	100	--------	--------	--------	--------	17	35
In 5th year	20	100	--------	--------	--------	--------	20	42
Totals	48	100	--------	--------	--------	--------	48	--------

TABLE IV.

Composition as to age groups and relative maturity of a collection of 51 females taken by traps in Baker Bay, Columbia River, July 3, 1919.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 3d year	1	100	--------	--------	--------	--------	1	2
In 4th year	24	100	--------	--------	--------	--------	24	47
In 5th year	17	100	--------	--------	--------	--------	17	33
In 6th year	3	100	--------	--------	--------	--------	3	6
Stream nuclei—								
In 3d year	--------	--------	1	100	--------	--------	1	2
In 4th year	4	100	--------	--------	--------	--------	4	8
In 5th year	1	100	--------	--------	--------	--------	1	2
Totals	50	98	1	2	--------	--------	51	--------

TABLE V.

Composition as to age groups and relative maturity of a collection of 41 females taken by beach seines on Sand Island, Columbia River, July 7, 1919.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 2d year	--------	--------	--------	--------	5	100	5	12.4
In 3d year	1	50	1	50	--------	--------	2	4.8
In 4th year	20	100	--------	--------	--------	--------	20	48.8
In 5th year	8	100	--------	--------	--------	--------	8	19.5
Stream nuclei—								
In 3d year	--------	--------	--------	--------	4	100	4	9.7
In 4th year	1	100	--------	--------	--------	--------	1	2.4
In 5th year	1	100	--------	--------	--------	--------	1	2.4
Totals	31	76	1	2	9	22	41	--------

TABLE VI.

Composition as to age groups and relative maturity of a collection of 102 females taken by troll off the mouth of the Columbia River, August and September, 1918.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 2d year	--------	--------	1	20	4	80	5	5
In 3d year	21	84	4	16	--------	--------	25	24.5
In 4th year	19	95	1	5	--------	--------	20	19.5
In 5th year	19	100	--------	--------	--------	--------	19	18.5
Stream nuclei—								
In 3d year	--------	--------	2	100	--------	--------	2	2
In 4th year	3	100	--------	--------	--------	--------	3	3
In 5th year	27	100	--------	--------	--------	--------	27	26.5
In 6th year	1	100	--------	--------	--------	--------	1	1
Totals	90	88.3	8	7.8	4	3.9	102	--------

TABLE VII.

Composition as to age groups and relative maturity of a collection of 95 females taken by troll off the mouth of the Columbia River, August 13, 1919.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 2d year	--------	--------	1	50	1	50	2	2.1
In 3d year	9	60	6	40	--------	--------	15	15.8
In 4th year	63	95.5	3	4.5	--------	--------	66	69.5
In 5th year	4	100	--------	--------	--------	--------	4	4.2
Stream nuclei—								
In 3d year	--------	--------	1	100	--------	--------	1	1.1
In 4th year	6	85.7	1	14.3	--------	--------	7	7.3
Totals	82	86	12	13	1	1	95	--------

TABLE VIII.

Composition as to age groups and relative maturity of a collection of 63 females taken by troll in Monterey Bay, June 19 to 21, 1918.

Age groups	Number of specimens and per cent which would mature during:						Total	
	Year taken		Following year		Second year following			
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Ocean nuclei—								
In 2d year	--------	--------	1	50	1	50	2	3.2
In 3d year	15	29	36	71	--------	--------	51	81
In 4th year	6	100	--------	--------	--------	--------	6	9.5
Stream nuclei—								
In 3d year	--------	--------	1	100	--------	--------	1	1.6
In 4th year	3	100	--------	--------	--------	--------	3	4.7
Totals	24	38	38	60	1	2	63	--------

TABLE IX.

Composition as to relative maturity of a collection of 144 females taken by troll in Monterey Bay, California, June 29, 1915. Determined from a study of the eggs alone.

Age groups	Number of specimens and per cent which would mature during:		
	Year taken	Following year	Second year following
Number	108	35	1
Per cent	75	24.3	.7

TABLE X.

Composition as to relative maturity of a collection of 64 females taken by troll near Drake's Bay and Fort Bragg, California, July and August, 1918. Determined from a study of the eggs only.

Age groups	Number of specimens and per cent which would mature during:		
	Year taken	Following year	Second year following
Number	43	18	3
Per cent	67	28	5

From the data contained in these tables the following generalizations may be made:

1. The fish taken in the ocean off the mouth of the Columbia River contain, in the spring and early summer, approximately 70 per cent of individuals which will not become sexually mature for one or two years.

2. By the middle of August this condition has changed so that nearly 90 per cent are fish which will soon enter the river for the purpose of spawning. The rate at which this change takes place and the time at which it occurs have not yet been determined, but will be taken up in the later report.

3. A comparatively small percentage of the fish found just within the mouth of the Columbia River are immature. It should be mentioned in this connection that it is only occasionally when unusual tidal conditions obtain that any immature fish are taken inside the mouth of the stream.

4. The fish taken by troll in Monterey Bay in June contain a considerable proportion of immature individuals. The data obtained in 1918 are most reliable, and indicate that only about 40 per cent of the fish taken would have spawned during the same year. The data for 1915 indicates that 75 per cent were mature, but selection may well have taken place in making this collection which, as noted above, consists of egg samples only.

5. The fish taken near Drake's Bay and Fort Bragg in July and August, 1918, contain approximately 30 per cent of immature fish. It is of interest to note that this is an approach to the conditions found off the mouth of the Columbia River in August and suggests that the composition of all the schools found near the coast changes materially during the summer season.

GEAR USED FOR SALMON TROLLING IN CALIFORNIA IN 1920.

By W. L. Scofield.

Object. These notes, by no means complete, are intended to be a rough record of the type of gear used in open sea salmon trolling in California at present (1920) as a partial supplement to the system of triplicate receipts for statistics of catch recently installed by the Fish and Game Commission. The fact that gear and methods have changed decidedly in the past few years and no doubt will continue to change makes this summary necessary.

The notes deal chiefly with *gear* used. Such subjects as history of trolling, points at which trolling is practiced and its extent, location for trolling in a given local area, prospecting for schools, and deep vs. shallow fishing, although most important, are omitted or merely touched upon here.

Variation in Methods. There is considerable variation in methods and equipment, with great divergence of opinion on most of the subjects taken up in these notes. While the industry was new this was an advantage, as established custom did not limit experimenting, but the results of the experimenting were not kept in definite form to be used, each fisherman satisfying only his own opinion without giving others the benefit. As a result there has been much duplication and improvement has been slower than need be. As fishing practice is now more established future improvements will result from more accurate experimenting with definitely recorded results.

Location for Trolling. Most of the fishermen move from one region to another following the salmon runs. The Monterey season opens first (January or February) and the local Monterey fleet is doubled or trebled by boats that go down from northern points, chiefly from San Francisco. Toward the end of the Monterey season (June) these boats begin leaving for San Francisco. They either fish for a time out of San Francisco or Point Reyes or go on up the coast to Bodega Bay, Fort Bragg and Shelter Cove. About August they begin returning to San Francisco. This year several boats, after completing the season at Shelter Cove, went farther north, some bound for Astoria.

In a given region the greatest and most difficult single factor in success is picking the good place to troll. Some days the big catches are made near shore in shallow water. At other times the trolling is best far out in deep water. In Monterey a quite generally believed theory is that schools come up from the south, enter the bay to feed for a few days and then leave. Other fishermen cite cases where the schools come from the north. Some fishermen prospect far out in order to locate entering schools. Cases are known where such a school has been fished day after day on its way to Monterey and while in the bay. Other schools have been followed far up the coast.

In the choice of location most fishermen merely follow some "hunch" and go it blind, keeping an eye on the other boats till they see someone landing fish and then go to that locality. When a large school is biting the whole fleet is often bunched in a small area. A plan often followed at Fort Bragg is to start trolling near shore with a shallow set and work farther out, gradually increasing the depth of line while prospecting for a school. Undoubtedly the successful fishermen have gathered a great amount of knowledge from experience but these "trade secrets" are not discussed freely. A knowledge of the habits of sardines, anchovies and squid is undoubtedly a help to some fishermen. Little is known of the effects of local currents carrying food and the consequent behavior of salmon.

Deep vs. Shallow Fishing. The most successful fishermen experiment at different depths and prospect to locate schools. It is a common saying that small Chinooks are caught more often in shallow water near shore. Silver salmon are said to be caught near the surface. There are, however, many exceptions. Some days when the fish are feeding actively the large Chinooks are caught near the surface. A common method of prospecting is to set one line with two to five fathoms of main line out (above leads) and the other line set with 10 to 20 fathoms out. Good catches are made at a great variety of depths on different days and practically nothing is definitely known of the reasons. Whether or not different schools feed differently is not known. Whether or not the weather affects the depth is not known, but some fishermen work on the theory that deep fishing is best on a clear bright day and that the set should be shallow for cloudy dark days. This suggests the possibility of plankton sinking to greater depths on clear days, small fish following the plankton and salmon following the small fish. Practically nothing is known of the effect on salmon of different water temperatures. Color of the water is believed by fishermen to be important. Clear water is believed to be poor for salmon fishing and at such times deep fishing is said to be more successful than shallow. Dark, murky or even reddish water is thought to be best for salmon catches and can be fished nearer the surface. The "red water" of deep color sometimes seen along shore is not good for trolling.

Boats. The type of boat most used is a clipper bow boat of wide flare forward and a pointed compromise stern. Often there is a small cockpit near the tiller and a high narrow house open at the back that is little more than a wind and spray screen when standing at the wheel near the engine. As the change from sail to power fishing has been recent there are a number of converted sailboats in use, especially the small Mediterranean type of boat that formerly used a latine sail. There are also a number of converted pleasure boats of a great variety of types. The pointed stern is usually favored rather than a rounding fantail stern because with the narrow stern it is easier to haul a fish up alongside on either side while still operating the tiller. The first troll boats were square sterns. Then the rounding or fantails were found to be better suited to landing the fish as there were no corners for the line to catch on and the stern is low in the water. The low stern was not so good when the boats began going out farther in rough water. Now that two-line fishing is almost universal the bluntly pointed compromise stern is used most.

As fish are becoming less plentiful the tendency has been to use increasingly larger boats capable of going farther out with comfort. The clipper bow type ranges in size from 20 to 40 feet over all with 30 feet as about the average size. The few 40 foot boats usually fish four poles.

The older boats have only a small hatch forward to allow a man to crawl below deck. A recent tendency toward comfort has been to raise the forward deck to allow more room below and a number of boats now have a low house extending forward with portholes to admit light and air. This could be more general since the forward deck is not used except for stowing the anchor and chain.

Nearly all boats carry but one fisherman. The larger boats fishing four lines sometimes carry two men, one handling the starboard lines and the other the port, but frequently one man operates the boat and handles four lines. The catch of a large boat is usually not equal to the catches of two smaller two-line boats, so experienced fishermen prefer to fish alone and not divide profits. Many of the one-man boats are decked over the stern and this is much more dangerous for the fisherman than having a small cockpit. The gunwale is only three or four inches high, the deck is wet, the boat rolls in a rough sea and while landing a fish the fisherman often has to keep one leg on the tiller so that his chances of going overboard seem fairly good, and once overboard with the engine running and his rubber boots too heavy for swimming, his only chance is to be picked up by some other boat.

Engines. Boat engines are of one and two cylinders, the majority being one-cylinder. The two-cylinder engines are nearly all 12 horsepower. The one-cylinder engines develop 6 or 8 horsepower capable of giving a boat speed of about seven miles per hour. The Hicks engine is the most popular engine for trolling boats, but there are many Standard engines in use. In all there are about 20 different makes used, including the Ford automobile engine. Eastern engines built for pleasure boats are also used, such as the Buffalo and Scrips. Most of the boats under 30 feet long have a one-cylinder and boats over 30 feet have a two-cylinder engine.

Speed of Boats. When trolling the engine is choked down till the boat travels at from 2 to 4 miles per hour, 2½ to 3 miles is usually preferred. The speed is greater when fishing near the surface. The deeper the lines the slower the boat is run. This is partially based on the theory that the fish on the surface are more active in taking bait or spoon and that fish deeper are more easily tempted by an object moving more slowly. A greater influence in slowing down for deep fishing is the fact that the line may be given a deeper set with the addition of but few extra weights. The slower the speed the deeper the set for a given amount of leads and hauling in a deep set, heavily weighted line on a rapidly moving boat with the resulting water drag on the line is back breaking work, so that the theory of deep fish being more sluggish fits in nicely. The speed is greater when fishing spoons rather than bait is used. Most spoons do not have the proper motion (spinning or side to side weaving) when the boat is run as slowly as is customary in bait fishing.

Poles. Poles are made from young peeled saplings, seasoned and trimmed down, usually of pine, eucalyptus or Douglas fir. Many bamboo poles are used, a single large pole or three small diameter poles lashed together. Often a short section of bamboo is lashed to the pole near the tip as a reinforcement at the point where a break is most apt to occur.

For small boats a general rule is to have the length of pole equal to the length of the boat as this is believed to give better balance. Boats using four poles have two short poles forward and two very long poles aft. Twenty-five feet is about the average length of pole.

Placing of Poles. Since there are many different styles of boats used there is great variation in the arrangement and position of the poles on the boat, each fisherman following his own ideas to best fit the deck plan of his boat. In some cases the poles are far forward, in most cases amidships and in some cases far aft. When the boat is small and of narrow beam the poles are usually crossed so that the base of the starboard pole rests in the scuppers of the port gunwale. This arrangement does not require a mast. In large boats the poles are used with a short mast, the base of the pole fitting into a socket or bolted at the foot of the mast. Since the distance from the mast foot to the gunwale is short, the pole when under strain has a great leverage. The strain is relieved by guy lines run from the bows. When very long poles are used even on larger boats they are sometimes crossed thus giving a longer pole base support within the boat.

Pole Supports. In all cases the pole has a vertical support on the gunwale to give the tip the necessary elevation. These supports may be simply two boards nailed together like a letter X, or a single board with a U notch cut in the upper end to receive the pole. Some have a notch cut to curve aft so that the pole jams in and is held down tight when the boat rolls violently. Other supports are made by bending the end of an iron rod into a U-shaped receiver for the pole.

Stowing Poles. When not trolling the poles are seldom left spread because of the danger of being broken. In some cases they are laid on deck along the gunwales, sometimes lashed to the top of the house with their bases in the bows, often drawn up vertically beside the short mast, fitting in notches at the mast head. Sometimes the pole base is hinged so that the poles may be lowered aft against the top of the house. In a few cases the mast is set on a hinged base so that mast and poles may be lowered at night or to pass under a bridge.

Pole Line. In trolling the main line is not attached to the pole directly. There is a short large-sized line or "pole line" with one end tied to the pole tip and the other end provided with a snap hook which is snapped into the main line at any desired point. The upper portion of the main line then hangs loose from the snap to the stern of the boat and provides a very convenient method of pulling in the line, since the pole line and snap are from 15 to 25 feet out from the stern while trolling.

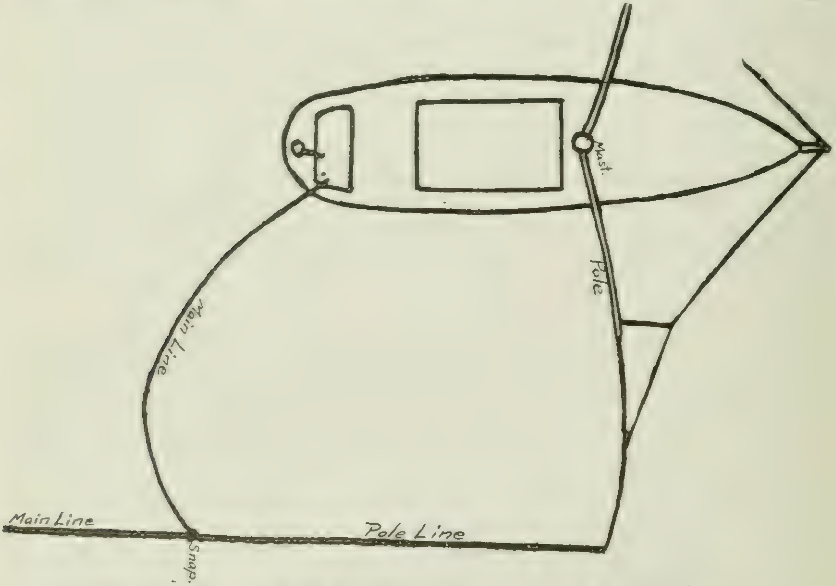


FIG. 13. Diagram showing gear arrangement on a salmon boat.

The pole line is a few feet longer than the pole so that it may be unsnapped from the main line and snapped into a cord loop on the gunwale near the stern when the main line is being hauled or when the poles are stowed against the mast. This arrangement easily allows the main line to be fished at any desired depth. The snap may be used in the loop of any lead or in loops tied in the main line two and one-half or five fathoms apart. The main line loop is made by doubling back the line and tying a simple hard knot leaving two or three inches free to form the small loop, just enough to receive the snap conveniently.

Plan of Rig. Although there is great variation in details of the arrangement of weights and line the "taper line" is almost universally used. The taper line is heavy (large) at the top, tapering in size toward the bottom. The size of the leads also tapers off, with the lightest at the bottom. The object of the tapering size of line is largely to avoid loss of the whole line when the lower hooks catch on rocks.

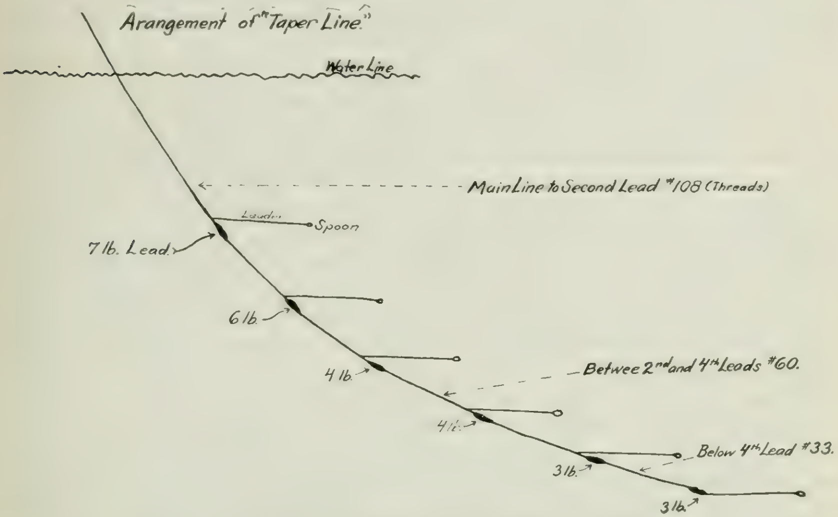

Arrangement of "Taper Line."
Water Line
Main Line to Second Lead #108 (Threads)
Leader
Spoon
7 lb. Lead
6 lb.
4 lb.
Betwee 2nd and 4th Leads #60.
4 lb.
Below 4th Lead #33.
3 lb.
3 lb.

FIG. 14. Diagram showing arrangement of a taper line.

The strain breaks the line only part way up so that only the bottom portion is lost. Also the decreasing size of line and leads decreases the water drag on the lower portion where the drag is hardest. The tapering size of leads toward the bottom has the effect of allowing the far end of the line to trail out more nearly approaching the horizontal, thus bringing the bottom three or four hooks within a more limited vertical range. This plan of rig allows great variation in depth of fishing without changing the rig. When it is desired to fish near the surface the bottom three leads and leaders may be paid out, the lightness of rig being an advantage. To increase the depth, one or two more leaders are paid out. When all leaders are out the depth is increased by paying out more main line (up to 10 fathoms. Over 10 fathoms greater depth is best obtained by adding more lead).

When a school is located the depth of the school may be determined by noticing which hook is taken and the taper line is then lowered till the second or third hook from the bottom is at the determined depth. Thus the bottom four hooks are brought close to the desired depth.

In taper lines the size of the line is tapered by three or often four changes in size. There is no uniform plan of taper lines approved more than another. An arrangement often used is a No. 108 main line to the second lead from the top, No. 60 line between the third and fourth leads and No. 33 or No. 30 below the fourth lead. (See paragraph on Line Sizes.)

Another plan of rig rarely used is very different from the taper line in that the object is to have the hooks fall at approximately equal distances apart vertically instead of within a limited vertical range. In this plan a uniformly heavy line is used (No. 144 for example) with the leads arranged just the opposite to the taper-line plan, that is, the lighter on the top and the heaviest at the bottom. With this arrangement the line is more nearly vertical and can be given a deeper set than the taper line. This line offers the greatest resistance in the water and if snagged on the bottom the whole line, with all the hooks and leads, may be lost.

Number of Lines Used. The number of lines used from a single boat varies from one to four with two as the usual number. Early in open sea trolling one line was used but is seldom seen now. Nearly all boats use two poles with a line from the tip of each pole. An occasional boat fishes a third line directly astern but this line is lightly weighted to keep near the surface. An occasional boat fishes four lines from *two* extra long poles, in which case the two additional lines are attached about midway out the pole. Several of the largest boats fish four lines from four poles, two short poles placed well forward and two long poles placed about at the boat's greatest beam in order that these lines may be as far out as possible to avoid tangling with the forward lines.

Whatever the arrangement of lines, care is used to keep the lines separated to avoid tangling while set or while hauling in. The fisherman stands in the cockpit or on the deck far aft so that he may control the tiller with his foot while hauling in. In good weather the tiller is often disregarded but in a strong wind or current a fairly straight course is kept because a sharp turn is apt to tangle lines.

Number of Hooks per Line. The number of hooks used on each line varies from one to nine but five or six is the usual number. Most of the lines are rigged with six hooks (or spoons). Lines rigged with nine hooks are sometimes used in prospecting but when fish are located and fishing is begun the number is reduced by removing leaders and leads. A two-hook line is occasionally used in surface fishing.

Line Sizes. The line commonly used is a cotton seine-line which is made in three grades, soft, medium and hard laid. For trolling the hard laid line is used. Practically all line used is made up of three strands twisted, each strand being made up of a number of threads. A four strand line is rarely used. The sizes of line are designated by a number which represents the total number of threads. For example No. 30 is a line of 10 threads to each of the three strands. Up to No. 36 the sizes are numbered at the addition of each three threads, as No. 21, No. 24, No. 27, etc. From 36 to 60 the addition of six threads is used in numbering, as No. 36, No. 42, No. 48, No. 54, No. 60. Above 60 the size numbers designate the addition of twelve threads as No. 60, No. 72, No. 84, No. 96, No. 108, No. 120, No. 132, No. 144, No. 156. The sizes of line commonly used range from No. 21 to No. 156.

The main line varies greatly in size according to the arrangement of leads. With a deepset heavy weight line No. 132, No. 144 or No. 156 is used. The upper portion (above the leads) of a "Taper Line" varies from No. 84 to No. 156 but sizes from No. 108 to No. 144 are more frequently used.

Leaders are No. 21 to No. 42 but Nos. 27, 30, 33 and 36 are the usual sizes, No. 30 being used most.

The bottom portion of the taper line is usually the same or more frequently one size larger than the leaders. Some taper lines have a different sized line between each two leads, as for example from the top downward, No. 144, No. 108, No. 84, No. 60, No. 48, No. 36. Light taper lines generally use only three sizes as No. 108 to the second lead from the top, No. 60 between the second and fourth leads and No. 33 below the fourth lead. A more frequent arrangement of sizes for taper lines is four sizes—No. 144 to the first (top) lead, No. 108 from the first to third lead, No. 60 from third to fifth lead and No. 33 below the fifth lead.

The size of line makes no apparent difference in the catch. Evidently the fish are no more wary of a large line than of a small. The line must be strong enough to hold the strain of a fighting salmon added to the resistance of line and leads in the water. Beyond this the individual preference of the fisherman determines the size. The very large lines are better in that they do not cut the hands so much while hauling in but they offer a decidedly greater resistance in the water and require harder pulling and more lead.

Color of Lines. Opinions are conflicting as to the best color for lines. Some fishermen use the white untreated line as it comes from the store. Most fishermen tan the lines brown, more for the purpose of preserving than making the line invisible. Some fishermen dye the lines green, believing that this color decreases visibility and insures better catches. Blue line is sometimes used. Many fishermen believe that color makes no difference in the catch.

Depth of Lines. On a two-pole boat the poles are usually elevated so that the line enters the water at a point about opposite the boat's stern. The line usually enters the water at an angle to the water surface of 30 to 45 degrees. Water resistance then curves the line astern. The taper line curves astern till the bottom of the line is nearly horizontal. The actual depth reached by different types of line is not known and makes no particular difference to the fisherman except in avoiding snagging rocks. He is chiefly concerned with the relative depth for his plan of rig, that is, how much line to pay out to bring his hooks to the depth where fish are biting best that day. A six-hook taper line with six fathoms between leaders means 30 fathoms of line. This line is fished with from 0 to 40 fathoms of line (above top lead) so that a total of 70 fathoms of line may be out in extreme cases but the greatest actual depth reached is probably not over 30 fathoms assuming the average angle of the line to be about 25 degrees to the water surface. This is an extreme case since 25 fathoms of main line (above leads) is generally the greatest amount used and 5 to 10 fathoms are most frequently used. With 10 fathoms out (40 fathoms total) the usual depth reached is probably 20 fathoms.

With the ordinary arrangement, a total of 27 to 30 pounds of lead and 10 fathoms of main line (above leads), the paying out of more main line does not materially increase the depth because the water resistance to the large line merely trails the whole gear astern. A greater depth is then obtained by adding more lead rather than more main line. The size of the main line is an important factor in depth because a given weight will take a small line much deeper than a large line.

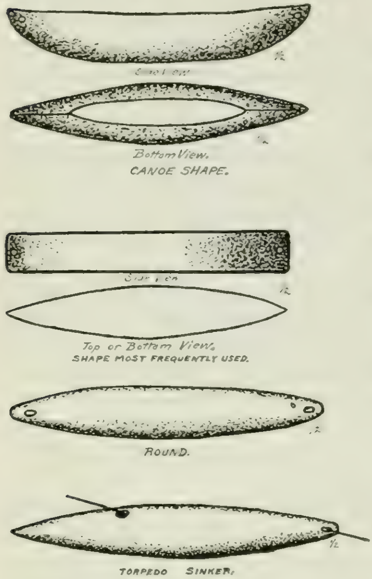


FIG. 15. Types of lead sinkers.

Leads. Although suitable lead weights may be purchased, they are usually home-made, an easy method being to bend two pieces of strap iron into a rough boat shape pointed at both ends and pour in the molten lead, using a sheet of paper over sand for bottom. Some leads are made rounded and pointed at each end. Others are quite carefully moulded in boat shape with the bottom tapered back and smaller than the top. This canoe shape is intended to ride upright with the least possible resistance to the water but it fails of its purpose because it is supported at an angle by the main line and its points of attachment, being near the top, allows the bottom to shear off to one side (skate). The result is that the weight meets the water broadside instead of bow on as intended. The lead cast in a rough boat shape with straight bow and stern with top and bottom the same size and shape is the lead most used because it rides straight without skating, is the simplest and easiest to make and does not roll on the deck. It is generally agreed that the best possible shape is the round lead (cigar shape) elongated and pointed at each end. This lead offers the least possible resistance to the water and therefore greater depth can be had with less weight, but it has two disadvantages, the greatest of which is that it rolls on the deck and is a great inconvenience in tangling up the lines when on deck. It is also expensive to buy or, if home-made, very difficult to mold.

Boats coming down to the California coast from the north (especially the Columbia River boats) frequently carry much larger leads, a common shape being a round lead of large diameter, slightly elongated with bluntly rounded ends, the lead being more the shape of a keg than a cigar. This same general shape is sometimes used slightly flattened but this shape usually sheers off so that the lead meets the water broadside. Another lead occasionally seen is a very large round lead pointed at one end and perfectly flat at the other, giving the shape of an old style beehive.

Another type of lead is credited with obtaining the greatest depth for a given weight. This is the ''torpedo sinker,'' cigar-shaped but the forward attachment to the line instead of being at the pointed end is about one-third of the way back on one side (top) of the lead. This method of hanging allows the forward point to dig downward into the water with the tendency to deepen the whole line. The objections to this lead, aside from the difficulty of rigging it, are that the free point tangles the line on deck, the lead rolls on deck and when in the water it gathers up floating seaweed in the angle formed by the line and the free point of the sinker.

The weight of a single lead in most cases varies from 2 to 10 pounds the usual weights being 3, 4, 5, 6, and 7 pounds. Occasionally a metal ring is cast in the lead for convenience in attaching the line, but this is apt to cut the line. The usual method is to bore a hole through the end of the lead and tie in a short piece of heavy line leaving a long loop or "strap" into which the main line may be tied with a bowline. An occasional fisherman rigs his leads with a swivel snap at each end so that the lead may be easily exchanged for a lead of a different size. This would be particularly convenient in prospecting and experimental fishing.

Amount of Lead. There is little uniformity in the total amount of lead used, each fisherman having his own ideas. Lines carry from 4 to 40 pounds of lead, 18 to 35 pounds being the most general range for taper lines of 6 hooks, with 27 pounds as the weight most frequently used. For surface fishing as little as four pounds of lead (two 2-pound leads) is sometimes used on a two-hook line.

In taper lines no arrangement can be considered typical but the weight is often distributed somewhat as follows from top to bottom—7, 7, 6, 5, 5, 3, totaling 33 pounds. Fishermen preferring less weight have some such arrangement as 7, 6, 4, 4, 3, 3, totaling 27 pounds. A frequently used total weight for a six-hook taper line is 29 pounds arranged 8, 6, 5, 4, 3, 3, pounds. Many of the fishermen that fish five hooks use as much or more lead than on the six-hook lines. The arrangement on such a five-hook line is frequently 10, 8, 4, 5, 3, totaling 30 pounds. Heavy deep set lines, though rarely used, are arranged from top to bottom somewhat as follows—4, 5, 6, 7, 7, 8, totaling 37 pounds.

On any one line the amount of lead used is not fixed but varies from day to day and may be changed several times during a day.

Leaders. Each hook (or spoon) is attached to the main line by a "leader" or short line 3 to 6 fathoms long. The weighted main line extends downward at an angle allowing the unweighted leader to trail out behind horizontally.

The length of the leader depends on the distance between leaders on the main line, the leaders being a little shorter than the distance between leaders. This is to avoid tangling in case the boat stops and the lines hang straight down, and also while hauling in the line. The distances used most commonly are 6 fathoms between leaders with a 5½-fathom leader. Another plan of rig frequently used is 3½-fathom leaders placed 4 fathoms apart. This rig with 4 fathoms between leaders allows more hooks within a limited vertical range when a school is located and found to be biting at a fairly uniform depth.

Attachment of Leader to Main Line. Leaders are attached to the main line from one to two feet above the lead sinkers, the usual distance being 18 to 20 inches. When ocean trolling for salmon started on the coast, it was the practice to attach the leader to the loop at the upper end of the lead but it was found that a hooked fish in fighting would tear loose from the hook because the heavy lead supported by the taut line offered too much resistance to the sudden jerk. For this reason the leader is a little above the lead so that the taut main line will give more spring to the sudden jerking of the fish. The bottom leader is usually attached to the bottom of the last lead in taper lines and in order to offer a less solid resistance to the fighting fish a light rather than a heavy lead is used at the bottom, a three-pound lead being most frequently used.

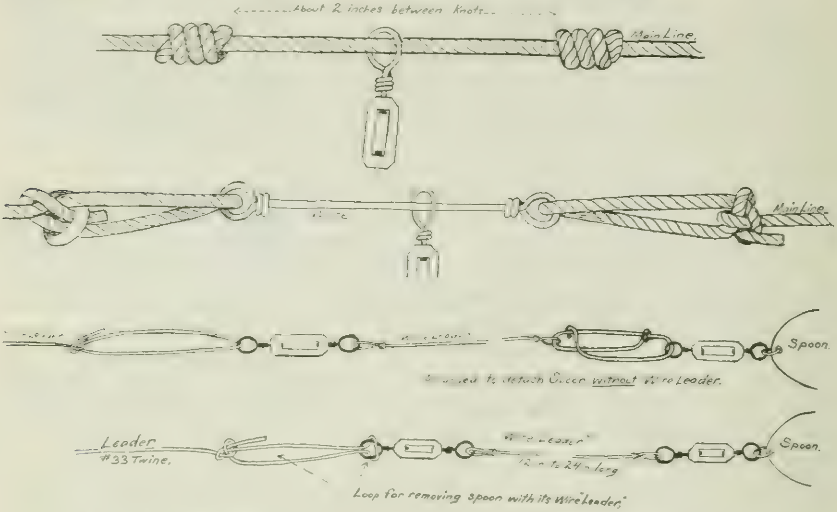

About 2 inches between Knots
Main Line.
Main Line.
Spoon.
to detach Spoon without Wire Leader.
Leader
#33 Twine.
Wire Leader
12 to 24 long
Spoon.
Loop for removing spoon with its Wire Leader.

FIG. 16. Diagram showing method of attachment of leader to line.

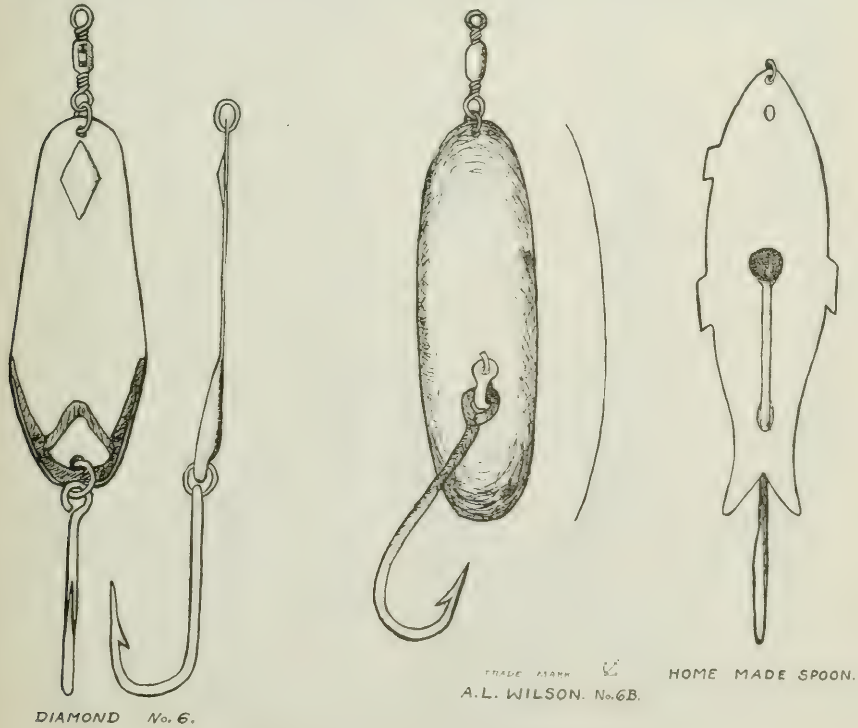
The usual method of attaching the leader is to tie a "running knot" in the main line which leaves the line straight as if threaded through three or four wraps of itself. The name "running knot" refers to the fact that the line runs straight through but the knot itself is perfectly solid. The line is then threaded through one ring of a swivel and another running knot tied at from two to four inches from the first. The leader is then tied into the other ring of the swivel with a bowline. The swivel protects the main line from being twisted by the leader and the distance between knots allows some play for the leader without crawling up or slipping down. The wire ring of the swivel is apt to wear on the lower knot and to avoid this a short wire section is sometimes inserted in the main line. This wire is about two inches long, threads through a swivel ring and looped at each end with the ends wrapped into a shoulder to keep the swivel. The main line is tied with a bowline into each loop of this wire section. By this arrangement the swivel plays on wire but the strain of the whole line now falls on the loop of the bowline bearing on the wire loop and this is apt to cut under a heavy strain.

Bait vs. Spoons. There is the greatest divergence of opinion among fishermen on the relative merits of spoon and bait. One fisherman will remain in because no fresh bait is available, another will use nothing but spoons, another insists on having both, while most fishermen change from one to the other at different times in the season. At Fort Bragg, for instance, there is a general belief that the spoons are more successful during the early part of the season and that bait is better for the latter part of the season. The majority of fishermen prefer fresh bait, but when it is difficult to get or expensive, they use spoons. At Monterey most of the Japanese prefer spoons throughout the season and most of the white fishermen prefer bait at all times even when it has to be purchased at from 75 cents to $2 a bucketful.

A few half-hearted experiments have been tried by using one line baited and the other rigged with spoons, but such trials have been brief and the findings merely personal opinion rather than actual figures of the catch.

A fresh sardine about seven inches long is almost universally preferred as bait. Squid tear off the hook. Anchovies are too small. Salted and formalin-preserved sardines are occasionally used but without much success, generally attributed to the loss of the bright shining appearance of the fresh fish.

Spoons. A variety of spoons are used, no one being a universal favorite. A number of fishermen prefer the hook attached solidly to the spoon (as in the Dubrow) because they believe that the salmon is more apt to be hooked, claiming that the swinging hook is apt to be brushed aside. Some fishermen prefer the Wilson spoon with a free swinging hook that is attached about one-third of the way up the spoon, because they believe this arrangement is more apt to hook the fish. However, most makes of spoons have the hook swinging from the lower end of the spoon, as in the McMahon, Diamond and Kewell-Stewart.


DIAMOND No. 6.

TRADE MARK

A.L. WILSON. No. 6B.

HOME MADE SPOON.

FIG. 17. Various types of salmon spoons.

The chief consideration in any spoon is its shape to govern its motion in the water. Although the spoons are of polished silver plating or brass to attract salmon by their shining, it is their action in the water resembling a swimming sardine that is most important. Some spoons are designed to spin in the water with a wriggling motion. Most spoons zigzag while constantly tipping from side to side so that the broad shining surface is displayed as often as possible. The Dubrow spoon for instance is curved to give a zigzag motion when trolled slowly and the tails are curved propeller fashion to spin the spoon when moving more rapidly. The McMahon spoon was the most popular at Fort Bragg during the 1920 season. This spoon tips rapidly from side to side when trolled and follows a fairly straight course. This tipping is continued even when the speed is greatly slowed down and the McMahon's popularity is largely due to the fact that it can be trolled slower than most other spoons. The Stewart and Wilson spoons tip less from side to side but follow a more zigzag course. Fishermen who have used Dubrow, Wilson, Stewart and McMahon spoons almost equally throughout a season claim to have had equal success with all four spoons but favor the McMahon because it is successful at a slower speed. There are quite a few home-made spoons in use, the spoon being cut from a sheet of plated brass. A successful home-made spoon is made on the Dubrow plan by riveting in a No. 11 or No. 12 long-shanked eye hook. Home-made spoons of the Kewell-Stewart type are most frequently used and are more easily made than the other types. The Wilson type is also seen frequently and is comparatively easy to make.

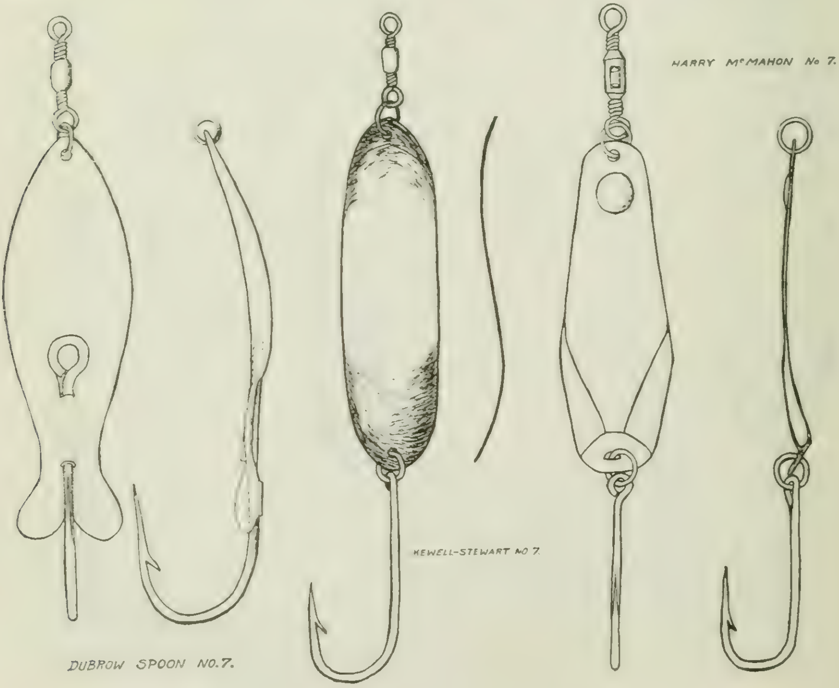


FIG. 18. Various types of salmon spoons.

The size of the spoon does not vary greatly, No. 6 and No. 7 being the favorites. McMahon No. 7 is used most although some No. 6 are used. The No. 6 Dubrow is used more than the No. 7. In Kewell-Stewart spoons No. 7 is used most. In Diamond spoons, No. 6 is preferred.

Bait Hooks. When fresh bait is used (sardines almost universally) the hook is passed twice through the head (through the eyes) of the sardine so that a couple of firm hitches are made on the head by the line. The sardine is then bent to one side at about the same curve as that of the hook and the hook passed through the body longitudinally, in at the mouth and the curve of the hook out at the anal opening leaving the shank of the hook inside the body. Because of this preferred method of attaching the bait a *long* shanked hook with a knob head is used. The knob, much like the head of a finishing nail, is the diameter of the shank and is formed by the shank diameter being reduced just below the knob.

Many of the hooks are made in Norway, especially the Kirby hooks, which have a slant to one side in addition to the curve so that the point sets at an angle to the shank. Most fishermen prefer a straight hook without the side slant and the Kirby hooks are often straightened in a vise before using. In all hooks the point is considered to bend in too sharply toward the shank and most fishermen bend the points outward a little before using.

When using a short-shanked hook the bait is more apt to be swallowed by the salmon and the hook is then difficult to extract and the leader is more apt to be cut on the teeth of the fish. A hook with a large diameter at the curve is preferred because it is less apt to tear out of the salmon's mouth.

The sizes used range from No. 9 (small) to No. 13 (large), sizes 11, 12, and 13 being used most. There is a quite general belief among fishermen that the first of the season runs small fish and the end of the season large fish. Some fishermen therefore use No. 11 sized hooks at the first of the season and No. 13 toward the end of the season. No. 12 is the most popular size for bait hooks.

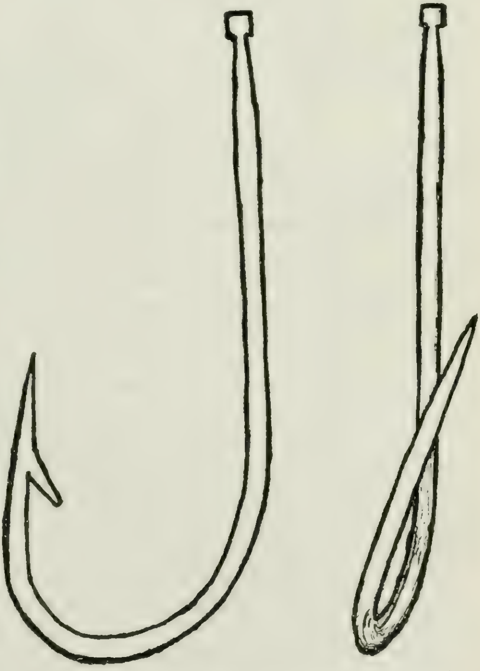


FIG. 19. Kirby hook No. 12. Natural size.

Hook and Spoon Leaders. A No. 33 cotton leader attached to the hook knob would be too large for convenient threading through the bait. For this reason a short hook-leader is used, a line of Irish linen being preferred as it is small, light, pliable, and strong. The most popular make is the Cuttyhunk, a three-strand linen bass line. The sizes used range from 24 to 60 but the sizes 27 and 42 are used most although all sizes between are occasionally used. For hook-leaders a No. 6 or No. 7 Irish flax salmon thread doubled is sometimes used. Other fishermen use No. 7 airplane thread doubled and twisted. Such thread is attached to the hook by taking a piece four or five feet long, making a double half or clove hitch over the hook knob in the center of the thread and twisting the ends.

The length of the hook leader varies from one and one-half to three feet, two or two and one-half being preferred by most fishermen.

A swivel is used between the hook-leader and main cotton leader, using a bowline at each end of the swivel. Some fishermen think that the loop of the bowline over the Cuttyhunk leader cuts in and weakens the leader, so they double back the end and tie a plain hard knot in the doubled Cuttyhunk. This may be attached to the swivel end by inserting the loop through the swivel eye and threading the hook and leader through the free end of the loop, making a reef hitch. This hitch also has the advantage that the hook and its leader may be removed by unthreading without untying any knots. This same hitch is frequently used at the lower end of the main leader where it attaches to the swivel, especially when a wire spoon leader is used. The main leader is less apt to cut on the swivel eye but the chief advantage is that the swivel, wire leader and spoon may be easily removed without untying any knots.

When spoons are used a Cuttyhunk spoon leader is sometimes used but a short wire leader is usually preferred because the linen thread is apt to be cut on the fishes' teeth and especially when a shark is hooked or is attacking the hooked salmon. For this purpose a two or three foot brass or plated brass wire is generally used, belt lacing wire being the favorite as it is pliable and very strong, but it can be broken if the fish in thrashing about gets a kink in the wire. To avoid this some fishermen use piano wire since it is exceedingly strong and so stiff that it is not kinked and broken, but its stiffness makes it much more inconvenient to handle, especially in removing spoons. In order to overcome this inconvenience some fishermen use some form of home-made stiff wire snap or fastener to free the spoon. This snap is sometimes inserted just below the swivel so that the wire leader is removed with the spoon, or just above the swivel of the spoon so that the wire leader remains attached to the main cotton leader. Some such scheme for easily removing the spoons is a great convenience because the wet spoons soon tarnish when left exposed to the air. To prevent tarnishing the spoons should be removed at the end of the day's fishing and placed in a bucket of salt water or wet sand.

The swivels used are of two types. Most spoons sold in the stores have the closed or barrel type attached but the wire knobs inside the barrel may wear down and break. The open type of swivel is preferred because the wire knobs can be seen through the openings and the swivel exchanged for a new one when wearing occurs.

Markers. In prospecting for a school a boat may be trolling for some time with no sign of fish and then suddenly have two or three strikes at once on each line. By the time the fisherman hauls in and resets each line considerable time has elapsed and the boat has covered quite a distance. It is then difficult to circle back and pick up the spot where the strikes occurred. Some fishermen carry a marker that may be heaved overboard at the point where the strikes occur so that the place can be picked up again without trouble.

The marker is a small float that supports a light flagged pole 6 to 10 feet long. The lightest marker is a cork float about 18 inches square and 4 inches thick, supporting a bamboo pole. The float is often of wood. The flagpole is passed through the float and weighted on the bottom end to insure floating upright.

Detecting a Strike. The drag of the line bends the pole tip backward. The rolling of the boat causes a motion of the pole tip due to lessening and increasing strain, but this slow movement with the boat roll is easily recognized and not confused with the more rapid jerking of the pole tip when a salmon is hooked.

Stiff poles are more apt to break with the sudden extra strain of a boat roll. In some cases this is obviated by using a coiled wire spring at the pole tip, but springs have not met with general favor.

Landing Fish. Hauling in the line takes some time and the hooked salmon has time to wear himself out fighting against the drag of the leads so that pulling him alongside is usually a hard dead pull without excitement. In shallow short-line fishing the salmon is more quickly pulled in and often puts up a hard fight, charging back and forth, even jumping clear of the water, tangling the gear generally and sometimes wrecking it. Silver salmon are credited with fighting much harder than Chinooks. Small Chinooks are said to fight harder than large fish, but this is probably due to the fact that small fish are more frequently hooked near the surface and on the shorter lines.

Some fishermen use a large landing net to bring the fish on deck, but a gaff hook is more commonly used. Sometimes the fish is so exhausted that he may be landed by a hand inserted in his gills. To prevent the fish flopping on deck he is killed by clubbing over the head with the gaff hook or a special club carried for the purpose.

Hauling in Lines. Practically all hauling in is done by hand. A few fishermen have small drums operated by the engine with rod and gearing, but this power hauling saves only the first (and hardest) pull to the first leader as weights and leaders can not be wound on the drum.

To prevent the line cutting the hands most men wear over the fingers a three or four inch section of automobile rubber inner tubing. The stores sell rubber "clinchers," which are a circular band of thick rubber with a sunken grove for the line and intended to be worn over the hand as is the auto tubing. The clinchers seem to serve better when cut in two and a cord used over the back of the hand instead of the complete rubber ring.

The line is coiled on the deck or in a small cracker box with the hooks inserted in notches in their proper order. The leaders are coiled separately from the main line in a smaller coil near the hook so that the bait or spoon can be thrown far out and tangling avoided.

Lost Fish. An attempt was made to learn the percentage of strikes that are lost but no records are kept and the opinions of fishermen are at such variance that nothing of value was learned. The percentage of lost fish evidently varies from time to time, possibly with the degree of hunger of the fish. Fishermen claim that on some days one-third of the strikes are lost, but on other days practically every fish is landed.

Whether or not small Chinooks are lost more than the large was not determined. The majority of fishermen think that many more small fish are lost than large, but they cannot be sure but that the small fish were silver salmon in most cases. Opinion is agreed that silver salmon are lost more than Chinooks and two reasons are given. Silvers are said to fight harder and their mouths are more tender. It is noticeable in looking over a mixed catch of the two species that many of the silver salmon have the lower jaw torn apart.

Salmon after being securely hooked are often attacked by enemies that are following the school. This is apparently more common in the northern waters, but is not uncommon at Monterey. Sea lions and seals are said to play a part, but sharks are the chief offenders. Sharks are often seen following a hooked salmon while the lines are being hauled in, even coming alongside, pursuing the salmon till he is hauled out on deck. It is no uncommon thing to see a 15-pound salmon delivered that has been bitten in two, leaving only the head and a little of the body on the hook. Spoons, leaders and leads are often lost from sharks biting off the lines and trolling is seriously interfered with, particularly along the northern coast and especially at Nogo and Shelter Cove.

THE FUTURE OF THE SARDINE.*

By Will F. Thompson.

Our greatest fishery is that for the sardine; indeed, it is overwhelming in importance, constituting during January, February and March of 1920 about 85 per cent of the total fish of all kinds taken. Will the sardine remain, or will it vanish at times as does its cousin the herring of the North Atlantic, and as the sardine itself probably does in British Columbia and Alaska? Upon the answer to that question depend millions of dollars and the welfare of a great industry. What are we doing to answer it?

We have not known thus far whether or not our sardine fishery is subject to great fluctuations—its history is so brief, having begun in 1914. It is possible to surmise that it is, because in the North Pacific this same species of sardine was practically unknown until two years ago—indeed the occasional specimen that was taken with the herrings was hailed as a curious stranger. Then they came in a great flood, cluttering the traps and the nets, and a canning industry of importance sprang into being. And if they were lacking once they may well be lacking again, not only in British Columbia but in California. So the most ordinary business sense dictates an energetic inquiry into the probability that such great changes will occur in California, and into the chance of foreseeing them.

This is, you will note, entirely aside from the chance of overfishing. And we do not know enough about our Pacific fisheries to know whether they can stand anything approaching the strain that the Atlantic herring and sardine have stood. Perhaps even in the Atlantic it is possible that the herring or sardine will one day suffer from man's operations as have other species. Our experiences on this coast have not been reassuring—that is certain—as witness the disastrous story of the halibut and salmon, for which our only great fisheries existed before the sardine and albacore became of importance. But before we can discuss overfishing, before we can tell whether it is happening, we must know something about those great fluctuations mentioned above, which may be confused with it. Indeed, in the sardine fishery the great natural changes in abundance may be so overwhelming as to completely overshadow depletion.

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* California State Fisheries Laboratory, Contribution No. 22.

To the study of these changes in abundance we have therefore addressed ourselves earnestly, along lines suggested by a scrutiny of the phenomena in the herring and other fisheries. It has been shown that the relative success of the spawning seasons is of predominant importance in explaining these changes. It has been found in the herring fishery that in some given year the spawning was very successful, and that the result was a vast number of herrings of a single age, and as year after year this great age-group became older it made the fishery very successful for that particular size to which it had attained.

To make this point clear a diagram is attached which, while it does not represent the actual condition in any particular fishery, may for our purposes be thought of as applying to that for the sardine.

The successive years are shown at the various levels, and the ages are shown in succession from left to right. With each passing year the groups fall each into the next higher age class, and thus the predominating group passes successively through the ages from the third to the eighth. The oblique line traces its course. The height of the blocks represents the relative importance of the particular age considered in the catch. It will be noticed that each age-group becomes smaller as the years go on, because of the annual natural death of a certain proportion, in this case assumed to be a fourth.

In the case of the herring a successful period of fishing was ushered in by the incoming of just such a highly successful age group as is first shown in the third year old class on the diagram, and a poor period was characterized by its lack. Such a phenomenon may be happening in our sardine fishery; and we are analyzing the catch to see whether it is or not.

For instance, during last season, the first we investigated, the group we may regard as being in their fourth year predominated and made, at Monterey, a good pack for ''half-pound oval'' cans, much as the dominating class in our diagram was in 1904. Will this year's catch be of fish one year older, hence less choice, and will the next be of fish two years older? Or will the catch continue to be of the same size and equally good for packing such cans? In other words, do the age-groups of fish vary widely in their abundance, as we have represented in the diagram, and will the fishery vary between success or failure with their growth in size, and with the presence or absence of a successful year? The packer, wondering whether the fishery is to remain good, and whether he will be able to pack ''quarter oil'' sizes, or obtain good ''half-pound oval'' sizes, naturally wishes to know the answer. We already have the catch of last year analyzed. What will our analysis this year show? It should, if we obtain our material and know from it

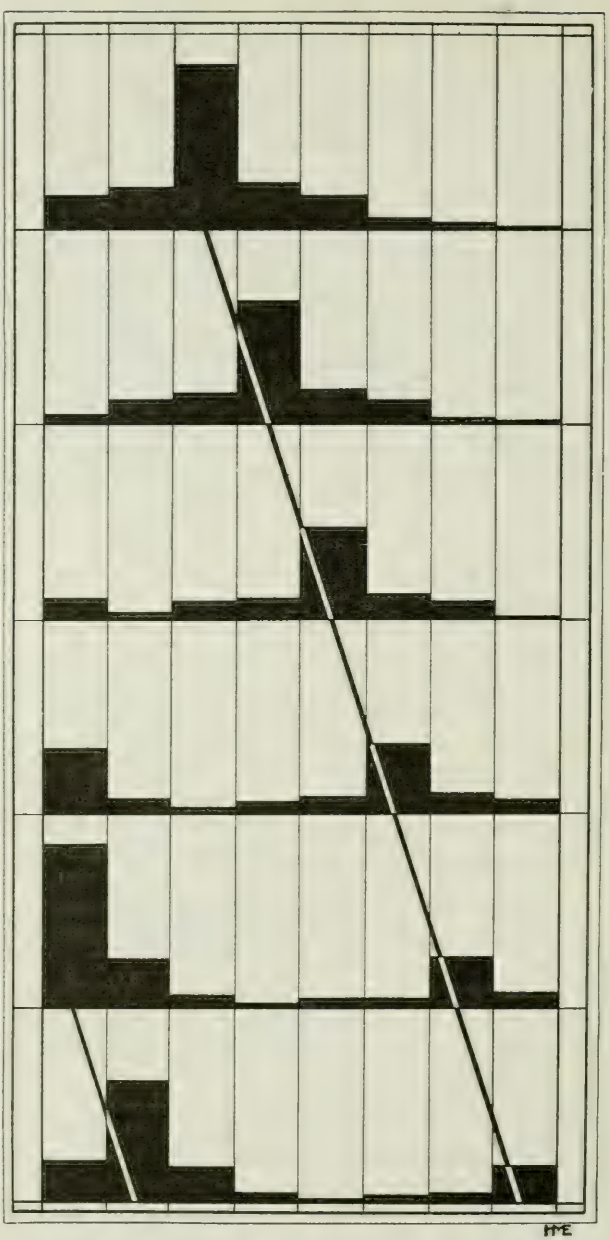

FIG. 20. Diagram showing theoretical effect of an abundant age group on the catch of successive years. The height of the blocks represents the relative abundance. If the diagram is thought of as applying to the sardine fishery, the following classification might hold:

Age I—Too small for canning.
II—"Quarter Oil" sizes.
III and IV—"Half-pound Oval" sizes.
V to VIII—Pound Oval and larger.

whether the predominating class is a year older, answer the questions of the packer, and indicate what we may expect in the future. Perhaps, when we know the exact rate of growth, we may be able to prophesy very exactly the character of the catch. Who knows, indeed?

But note the proviso, *if we know the rate of growth.* That indicates the importance of the fact upon which it is necessary to lavish much care and thought. It is a cornerstone for our edifice. So we are concentrating upon age and rate of growth.

Yet this knowledge of age is not sufficient unto itself. We must know whether our analysis of the catch really shows which age predominates. And there is only one way to do that, namely to take extensive series of samples for observation and comparison throughout the year. So there are two men stationed, one at Monterey and one at San Pedro, who are doing nothing else. Last year we obtained a great series of samples and are subjecting it to the closest analysis to see whether the age that predominates does so because of its actual abundance or because of some influencing factor. And so, also, the same is being done this year for comparison, to see whether the dominating class does become a year older. So far as we know, no fisheries investigation has been based as thoroughly and as carefully as will be that of the sardine.

And so we are confident that we will be able to answer the queries of the packer and the fishermen. We will be able to determine whether or not the fishery is to be one that varies greatly from success to failure through periods of years. We will be able to prophesy, if it is possible, as to the character of the coming catch.

But our objects are also to meet many other queries of the dealer, the packer, the fisherman, the legislator and the public, and what we have said in this article covers but one phase of our investigations; there are others as important. And we hope ultimately to be able to meet competently and scientifically that grave question which always awaits us in all discussions of the fisheries, that of the presence, the absence or the probability of overfishing, and its remedies.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

FEBRUARY, 1921.

Ignorance of the law is no excuse for violation of it. Therefore, because of continual changes, it is most necessary that you acquaint yourself with the existing statutes before going afield.

A SALMON NUMBER.

Certain details of the life history of the Chinook salmon, one of California's finest food fishes, have long been a mystery. Does a salmon always return to the stream where it was born? Why do salmon refuse food when in fresh water? Where do the two- and three-year-old salmon feed when in the ocean? Answers to these questions are being sought by scientists to complete our knowledge of the life and habits of this notable fish. In this January issue of CALIFORNIA FISH AND GAME we present a "Salmon number" containing several contributions bearing on the above points which merit thorough perusal by all our readers. Not only are these papers of more than ordinary interest so far as subject matter is concerned, but those by Dr. J. O. Snyder and W. L. Scofield are published results of the marking experiments and other investigations on salmon undertaken by the California Fish and Game Commission.

KLAMATH RIVER SALMON THREATENED WITH EXTERMINATION.

The Electro-Metals Company of San Francisco and Mr. A. P. Seybold ot San Francisco, have each applied to the Federal Power Commission for preliminary permits to build dams on the Klamath River to divert water for power projects. One of these projects is located above the town of Orleans and the other a few miles below this place.

Nothing in recent years has so threatened the salmon fishery as these proposals. The Klamath River still has a good run of salmon. A large cannery is located at the mouth of the river and large numbers of fish are used for food by people living along the stream. A large take of salmon eggs for the use of the hatchery is also secured on the Klamath River near Hornbrook. If the Federal Power Commission permits the building of these dams, 90 per cent of the spawning ground of the salmon in this river will be destroyed and ultimately the whole salmon run.

The power companies will argue that fish ladders can be built over the dams. Ladders, of course, could be built, but there is little chance that they would be successful on dams 100 feet high, or over. Furthermore, such fishways would be an impediment to the young salmon attempting to reach the ocean from the spawning grounds. Nor could a successful hatchery be maintained below these dams, for the salmon reaching such a station would not be mature and it would be impossible to hold them until ready for spawning.

The catch in the Sacramento River and other rivers in Alaska has fallen off during the past few years, and unless some of the better streams are protected as spawning grounds for these fish, the salmon will soon be a thing of the past. There is no opposition to power projects in general, but there is opposition to projects which destroy spawning grounds of salmon and other food fishes. Other streams where there is a poor salmon run, as for instance the Trinity River, should be utilized rather than the best of our salmon streams.

It is to be hoped that the above applicants will be denied permits and that the Klamath River and its tributaries will be permanently maintained as spawning grounds for salmon and steelhead, and thus continue to be a source of supply for the fishing industry and a resort for the angler.

IN MEMORIAM.

RALPH W. REQUA.

Ralph W. Requa, a former trusted employee of the Fish and Game Commission, departed this life July 7, 1920. He was born at Xenia, Kansas, November 26, 1874, being the son of George W. Requa, one of the pioneers of Kansas and a prominent citizen and politician.

Ralph Requa graduated from the schools of his native state and at the age of eighteen entered the United States Postal Service as a delivery mail clerk. This work was not to his liking, as he was interested in the conservation of fishes, so he soon entered the employ of the United States Bureau of Fisheries.

For several years he was employed as a messenger in the distribution of fish by the Federal Bureau of Fisheries, and the knowledge he obtained in traveling over the different sections of the United States in this work, was of great value to him later.

Mr. Requa resigned from the Bureau of Fisheries in June, 1895, to accept a position with the California Fish and Game Commission. He was placed in charge of the distribution work at Sisson Hatchery and subsequently became foreman and assistant superintendent, greatly assisting in the building up of this hatchery, as his practical knowledge was of great value in all lines of fishcultural work. Considerable of his energies were devoted to the improvement of automatic screens for the saving of fish from destruction in ditches and canals, and he patented several devices for this purpose. Many of the best screens in the state have been installed under his direction.

His arduous duties as superintendent of one of the first distribution cars undermined his health and for the last six years he was employed only periodically by the Commission on screens and aquarium exhibitions, although in charge of the salmon experimental work at the experimental station in Bidwell Park near Chico. An expert on the arranging and placing of fish in acquariums, his work at the different county and state fairs attracted wide attention.

He was married to Florence Getchell in 1901. Her death in November, 1918, hastened his end. He left two children, Francis and George Requa.

Untiring in his efforts in all lines of fishculture, there was no day too long or task too hard for him if he thought the work depended on his services. He was one of the faithful employees who have made the work of the California Fish and Game Commission one of the most successful of any in this or any other state.

Ralph W. Requa.

Ralph Requa was a man of the highest integrity, and his associates will ever remember him as a kind friend and a loyal champion of those whom he trusted as his friends. No nobler tribute can be paid him than the following extract from a letter written by a friend and colaborer of his in the work of the Fish and Game Commission: "He went with me into the high mountains and started me right in the fish planting business. I learned him then, the heart of him, as men will do when all alone in the high country. I formed a strong attachment for him and have always held it. He was another example of a faithful employee, martyr to a cause."

In the passing of Ralph Requa, the state has lost a good citizen, his children, a kind and loving father, and the Commission a dependable and faithful employee.—W. H. S.

THE 1920 BIENNIAL REPORT.

The Fish and Game Commission's 1920 biennial report to the Governor will be off the press early in the year. It is to be bound in an attractive cover giving a four-color reproduction of a Loch Leven trout. The report will contain full statements of the work and accomplishments of the past two fiscal years by department heads, together with many illustrations. The appendix will include statistical reports on fish planting, license sales, arrests, seizures and expenditures. In spite of war economy, the Commission has made a remarkable showing. Outstanding features of the past biennium are: The successful rearing and planting of over 30,000,000 trout and over 26,500,000 salmon; the splendid administration of commercial fisheries and valuable scientific research connected therewith; the establishment of a great chain of game refuges; and a worth while educational and publicity campaign.

SPORTSMEN'S AND ANGLERS' ORGANIZATIONS.

The sportsmen's and anglers' organizations of California or any state may be considered as wild life educational assets. Through them a greater number of people are made familiar with the fish and game laws; right sportsmanship is stimulated and the importance of conservation is better appreciated. The Fish and Game Commission stands ready to encourage these clubs in any way possible, for it feels that by cooperating with them both the sportsmen and the Commission will be benefited; the sportsmen will be more alert to the work of the Commission in its effort to insure the ever increasing numbers of fishermen and hunters with an adequate supply of fish and game, and the Commission by being more in touch with the people, will be better prepared to meet their demands and any lurking spirit of dissatisfaction.

The Commission feels that it can be of service to these organizations by loaning its splendid wild life films (or stereopticon slides) and providing a lecturer to explain the pictures, when desired, and acting as a clearing house for dependable information on game resources, fish and game conditions and fish and game laws.

PROPOSED FEDERAL HUNTING LICENSE.

Those interested in the working out of the Migratory Bird Treaty Act are disturbed over the small appropriation available for the enforcement of the act and the consequent small number of federal game wardens. The congressional appropriation of $142,500 permits the employment of but 29 salaried wardens.

That sentiment favors a stronger governmental support of the measure is evidenced by the action taken by the International Association of Fish, Game and Conservation Commissioners. At its recent meeting in Ottawa, the association adopted a resolution calling for the issuance of federal licenses for hunting migratory birds. Licenses in the form of special stamps to be issued by postmasters and attached to state licenses were recommended. It was estimated that the revenue from such licenses would amount to between $1,000,000 and $2,000,000, an adequate sum to be used for the protection of game.

GOLDEN TROUT.

Golden trout received wide distribution owing to the successful results in the hatching and rearing of golden trout at the Mount Whitney Hatchery in Inyo County. The California Fish and Game Commission has been able to stock many barren streams and lakes in the southern Sierra with golden trout. Until recently the stocking of streams was dependent upon the capturing of golden trout by hook and line and the transportation of the fish thus caught. Now the Mount Whitney Hatchery has an output of nearly one million golden trout annually.

During the past fall, under the direction of Commissioner M. J. Connell of Los Angeles, the golden trout fry from the Mount Whitney Hatchery have received wide distribution. With Deputy E. H. Ober in charge of the pack train, plants have been made in tributaries to the Middle Fork of the San Joaquin, Madera County. Until they received their quota of golden trout these streams were barren of fish life. The plan is to plant desirable streams and to keep the stock pure. Crystal Lake, which was planted in September, 1918, was found this year to be teeming with beautiful fish ranging from five to ten inches in length.

WHY?

Although the Fish and Game Commission has been having splendid success in convicting violators of the fish and game laws, yet their efforts are occasionally handicapped by some judge who fails to make a conviction possible. As evidence, the following may be cited:

Deputy Harrington arrested Mr. H. Zirn of San Pedro for having in his possession 250 pounds of spiny lobsters over the size limit of sixteen inches. Most of these lobsters measured from seventeen to twenty-two and a half inches in length, and were consequently illegal. When the case was tried by one of the San Pedro judges, two of the lobsters properly labeled were presented as evidence, but because these lobsters had been boiled to preserve them, the judge ruled that the evidence had been changed and therefore that the violator could not be ruled guilty.

Why should such unreasonable technicalities be advanced allowing a guilty violator to escape punishment?

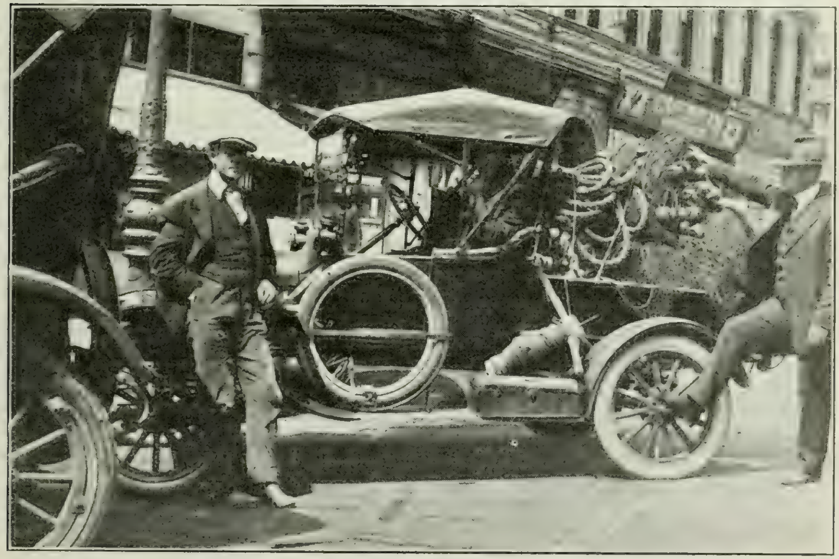

FIG. 21. Net 2,400 feet in length confiscated by deputies of the Fish and Game Commission at Richmond Harbor, August 31, 1920.

NETS CONFISCATED.

On August 31, 1920, deputies A. Mack, Bert Leahy and M. S. Clark of the Fish and Game Commission discovered two large "illegally" used nets at the mouth of Richmond Harbor. These nets were confiscated. One was found to be 1800 feet in length and the other 1600 feet, making a total of 2400 feet of net. One of the owners of the nets was captured and paid a fine of $100 in addition to the loss of the nets confiscated.

BOTTOM DROPS OUT OF THE FUR MARKET.

According to a letter written by Funston Brothers and Company of St. Louis, published in the Illinois Sportsman, October 14, 1920, the fur market is still stocked with the bulk of last year's catch and the above named company advocates, therefore, little if any trapping during the coming season. To explain the situation they write as follows:

> "One of the principal reasons why the dealer is carrying such an enormous stock is due to the fact that the manufacturing end of the business has had a strike since last May. Ten thousand men have been out, and a great many of them are still out. This has resulted in the fur dealer being compelled to carry the furs all during the manufacturing season, and he still has them on hand with a new fur season coming on."

It is stated that the market price of furs will be reasonable, the fur dealers being willing to sell at a loss, and that until conditions improve it is advisable that the trapper should not trap and ship furs this season. If they do the prices which they receive will not be remunerative, as financial conditions among the manufacturers are such that the fur dealers will be unable to buy much of the new fur.

Little is said of the conservation side of the question, but in order that the fur-bearing animals marketed should be saved from extravagant waste, it seems even more advisable to discourage the seasonal trapping of the year.

COMMISSION COMPLIMENTED BY BUREAU OFFICIALS.

Lewis Radcliffe and Henry O'Malley of the United States Bureau of Fisheries have recently been making an investigation of the fisheries of California and the conservation work of the state's Department of Commercial Fisheries. These officials appeared very much pleased with the work carried on by the California Commission, and stated that the Bureau of Fisheries appreciated the public spirit of the Commission in maintaining the preservation laboratory at San Pedro until appropriations would allow the Bureau of Fisheries to again support the project.

The Bureau of Fisheries is at present making a thorough investigation of the methods of caring for and preserving fishing gear in which $15,000,000 is now invested in the United States, exclusive of boats. The life of nets and other gear is very short under existing conditions, and other ways and means of increasing the length of time they can be used are being sought.

HUNTING AND ANGLING LICENSES.

There has been a remarkable growth in the number of hunters and anglers in the State of California, as evidenced by the sale of licenses. In 1914 the number of angling licenses totalled about 84,000 and the hunting licenses about 165,000. In 1919, the anglers numbered over 145,000 and the hunters 178,000. According to current compilations of the number of hunting licenses issued in the various states, Pennsylvania, New York, Ohio, Illinois and Wisconsin, in the order named, lead California in the number of hunting licenses sold. In the whole United States there are about 7,000,000 hunters who pay a license fee and it is estimated that over 3,000,000 more are exempted from the fee by various state laws.

DUCKS MOVE TO NEW FEEDING GROUNDS.

The lack of fresh water in the larger streams has greatly increased destruction to pilings by the teredo in or at the mouth of the San Joaquin-Sacramento rivers. Many wharfs along the Carquinez Straits have had to be abandoned and continual repairs are being made on others. Soft-shelled clams which heretofore have been restricted to San Pablo Bay are now thriving in Suisun Bay, with the result that such ducks as the canvasback and the lesser scaup are utilizing the upper bay more largely as a feeding ground.—H. E. F.

HELP SAVE THE WOOD DUCK

The wood duck, said to be the most beautiful duck in the whole world, is protected by federal law, but not all shooters are able to identify the females, or the males in immature plumage. In an attempt to prevent the killing of wood ducks by mistake, the Department of Conservation of Massachusetts has issued a poster giving colored illustrations of the wood duck in flight, showing its different plumages, with the request to "look before you shoot."

The following marks for field indentification are offered:

(1) Any duck with a white breast found near streams or fresh-water meadows in September or early October is almost certainly a wood duck.

(2) Any ducks, which when suddenly startled, fly away without quacking, have the tail longer and the neck shorter than that of the black duck, will probably be wood ducks.

(3) Any duck which can be heard uttering a peculiar note, sounding like "Oo-eek," is a wood duck.

GAME LAWS FOR 1920.

The total number of game laws enacted in 1920 probably will not exceed 60, which is about normal for "even" years, when only a few states hold legislative sessions. In the laws enacted further progress was made along the line of harmonizing state legislation with the migratory bird treaty act regulations.

The most important changes affecting big game were in New York and Quebec. New York reenacted the buck law and limited the hunter to one buck a season. The deer season was also modified in several localities. In Quebec the season was shortened 19 days on deer and bull moose, except in four counties, and 50 days on caribou.

Legislation of far-reaching importance looking to the preservation of quail and other upland game birds included an act of Congress, approved December 18, 1919, prohibiting the sale of upland game birds in the District of Columbia, and an act in Maryland prohibiting the sale of quail, ruffled grouse, introduced pheasant and wild turkey in that state.

For the convenient use of sportsmen and others the Biological Survey of the United States Department of Agriculture has compiled information resulting from game legislation, and this has been published as Farmers' Bulletin 1138. This contains a summary of federal, state, and provincial laws for 1920; a summary of laws relating to seasons, licenses, limits, sale and export; disposition of game raised in captivity; the text of the Lacey Act regulating interstate commerce in game, and of the tariff act prohibiting importation of plumage; the law protecting birds and their eggs on federal bird reservations; the regulation regarding hunting on national forests; the treaty for the protection of migratory birds; the migratory bird treaty act and the federal and Canadian regulations; text of order of Secretary of Agriculture permitting the killing of reedbirds; a list of officials from whom copies of game laws may be obtained; and a list of the publications of the Department of Agriculture relating to game. Farmers' Bulletin 1138 may be had upon request of the United States Department of Agriculture, Washington, D. C.

WRONG SEASON ON DOVES.

On the opening day of the dove season (1920), the writer and one of his friends went out for a try at the doves. We had to go about two and a half miles to an orchard where we found plenty of the birds. I got thirteen and my friend got eight. He had a twenty-two rifle and I used a shotgun. I could have taken my limit but I waited until I could take two at a shot, making them come at two and a half cents apiece.

As we started to come home we took a longer way back in order that we might shoot some jack rabbits for the dogs. I found three dove nests while hunting for the rabbits and my friend found four. Two of those which I found had eggs in them and one had squabs, almost ready to fly. The nests which my friend found held two eggs each. This seems to me to demonstrate quite clearly that the dove season opened too early.—CHARLES FOLLETT, *Merced, California.*

TWO DEER AT ONE SHOT.

We all hear of the man who discovers himself short of ammunition and uses this as an excuse for his inability to secure a deer, but it is seldom that we hear of a man lucky enough to secure his limit of deer in one shot. The opening day of the season found Fred McKenzie, an employee of the Ukiah post office, together with friends, camped on Baldy Mountain. On the day before leaving this camp, two three-point bucks appeared standing side by side. McKenzie pulled up and shot, the bullet passed through the neck of the first deer and struck the second in the base of the brain.

Although this sounds like the usual hunting story, it has been verified by Fish and Game Deputy B. H. Miller.

FACTS OF CURRENT INTEREST.

A more than ordinary rainfall during the winter months so scattered the ducks that bags have been small.

* * *

The comparatively small run of salmon the past year has emphasized the necessity of a careful scientific investigation of the life and habits of this fish, such as is in progress.

* * *

The first of the year finds the sardine canneries burdened with a large part of last year's pack. As the price of canned sardines advanced in price but a very small per cent, a reduction in price to move last year's pack means a distinct loss to the canner.

* * *

A new State Fisheries Laboratory is under construction at San Pedro. This laboratory will afford facilities for the scientific staff engaged in investigations on the commercial fisheries.

* * *

During the past biennial period 1891 arrests for violation of the fish and game laws have been made, and fines totaling $46,373 collected.

* * *

State lion hunter Jay Bruce has succeeded in killing thirty mountain lions during the past year. When it is known that this means a saving of at least 1400 deer, it will be seen that the salary outlay for Mr. Bruce is well spent.

* * *

A fisherman on the Sacramento River arrested for having illegal nets in his possession was recently sentenced to one hundred days in jail by Judge Quince of Benicia.

HATCHERY NOTES.

W. H. Shebley, Editor

TROUT AND SALMON DISTRIBUTION.

The distribution of trout and salmon fry from the hatcheries and ponds of the Commission was completed November 5. While the number of fry distributed was not as great as last season, the fry were in better condition and the distribution was systematically carried out, so that the results obtained were very gratifying.

With very few exceptions all the shipments were under the supervision of the car messengers and the hatchery employees and the fry were planted in good condition. Some of the shipments were turned over to applicants who have had several years' experience in planting fry and who used their efforts to make the work of distribution in the streams and lakes in which they were interested a success. On the long trips from the railroad stations to the interior districts, there were less fish lost than in any previous season, judging from the reports received from applicants.

There were about eight thousand cans containing sixteen and one-half million trout fry sent out from the hatcheries, by truck and distribution cars and, as far as can be learned, there was only one serious loss during the season and that was caused by the breaking down of a truck. This shipment was turned over to the Forestry officials who sent out a driver without an assistant. This driver neglected the fish during the time that his truck was being repaired and consequently a great many of the fish were lost. Our men on the distribution car were not to blame, as the Forestry officials who have had experience in planting fish were to handle this shipment. Mention is made of this to demonstrate the fact that our system of planting the fry is very successful.

The demand for trout fry was very great this last season owing to the depleted condition of the streams caused by the excessive fishing during the period of low water which has prevailed over the entire state for the last three years. The fish were confined to the larger pools and were easily taken by the anglers. Some of our best trout streams were fished almost to depletion during the period of drought and an increased number of fry will be necessary to restore the streams to normal conditions again as well as a shorter open season, so that the fish will have a chance to grow.

The present season in most of our fish and game districts is open too long to give the fry a chance to grow and mature into breeders. The season should be shortened by the coming legislature, so that the fry will have a chance to grow and give the anglers better sport.

SALMON EGG COLLECTING, FALL OF 1919.

The extremely low water of last fall prevented the salmon from entering the tributary streams of the Sacramento River on which are located the egg-collecting stations of the Bureau of Fisheries. Consequently, the number of eggs collected was very much smaller than usual and all the eggs that the Bureau could spare for our Mount Shasta station was 4,235,000.

The resulting fry were held and fed until late in the spring, when 3,100,000 of them were placed in the large rearing ponds connected with the Mount Shasta Hatchery. Here they made a rapid growth and were released in excellent condition during October in the tributary streams of the headwaters of the Sacramento River.

Twenty thousand of the fry were marked and will be liberated as soon as all danger of fin regeneration is over.

The run of salmon on the Klamath River did not reach our egg-collecting station in as large numbers as we expected as the lack of rain caused them to spawn lower down the river and in some of the small tributary streams miles below our racks.

A large percentage of the breeding salmon that enter the small tributaries of the Klamath River as well as the Sacramento tributaries are taken by persons with spears at a time when they are hardly fit for food. The taking of these fish by persons desiring them for food, when the fish are on the spawning ground is not only destructive to natural propagation, when confined to the number that can be legally taken, but there is a wanton waste of the fish by persons who spear them on the spawning beds and are forced to throw them away when they find them in no condition to use as food. Oftentimes fish are speared until a fish is taken that is considered edible. A large majority of the breeding salmon after they reach the spawning grounds are emaciated and covered with patches of fungus, making them unfit for food.

The take of salmon at Klamathon during the fall of 1919 was 4,974,000 eggs. Of these eggs 3,307,000 were taken to the new Fall Creek Hatchery, located twelve miles above Klamathon on Fall Creek, one of the finest streams of water for the rearing of fish on the coast. The resulting fry were placed in ponds and held until October, when they were liberated in good condition.

Extensive plans were made this fall to take a large number of salmon eggs at our Klamathon Egg-Collecting Station. The Bureau of Fisheries also was prepared to operate its Battle Creek and Mill Creek stations on the Sacramento River to their full capacity. The unusually heavy rainfall during November caused the streams to rise very rapidly and at the height of the salmon run, November 17, the racks at Klamathon were so badly damaged by the high water that the salmon that were ascending the river escaped above the racks and our take of eggs was considerably less than expected.

The racks at Mill Creek and Battle Creek stations of the Bureau of Fisheries were washed out at the height of the salmon run. The loss in eggs that could have been collected from the salmon which escaped above the racks is estimated at between 20,000,000 and 25,000,000, at all stations damaged by the high water. This would not be so serious during normal seasons, as the natural propagation would take place on the spawning beds and a certain percentage of the eggs would hatch, but during periods of torrential floods in the streams frequented by the spawning salmon, the shifting sand

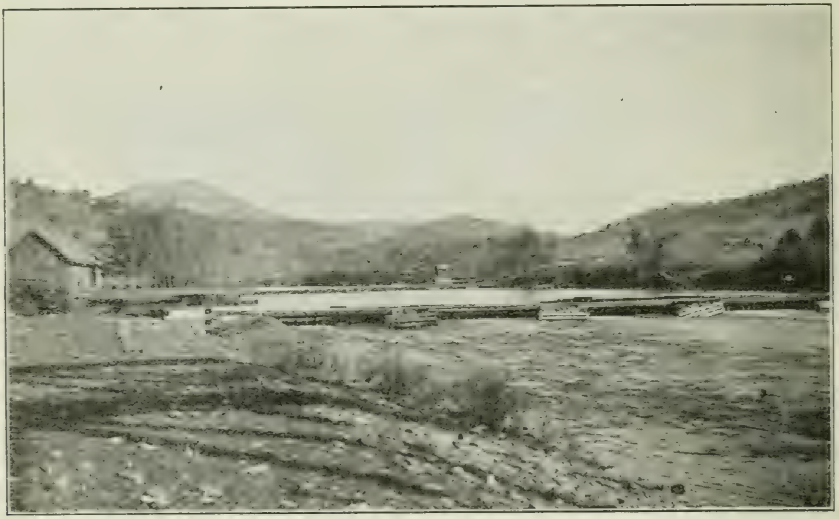

FIG. 22. Racks in the Klamath River used to capture salmon for spawning purposes. Photograph by L. J. Stinnett.

and gravel disturbs and moves the eggs and a great many of them are destroyed or are buried so deep that they cannot possibly hatch out.

The total take on the Klamath River was about 7,000,000 eggs, and from unofficial reports received the number taken by the Bureau of Fisheries was approximately the same.

While the loss in eggs is to be regretted we will be able to give the eggs collected extra care and, in a measure, make up for the shortage of eggs at the hatcheries.

SAN JOAQUIN RIVER SALMON.

The Kerckhoff Dam, property of the San Joaquin Light and Power Company, that has recently been completed, near Aubery's on the San Joaquin, prevents the passage of the salmon to their former breeding grounds on the upper reaches of the river.

The Merced River will no longer afford a spawning ground for salmon, as a large irrigation project is planned that will hold back the flood waters of the Merced in a lake to be made by the construction of a high dam across the river near Exchequer. Plans had been made for the construction of fishways over the small dams in the Merced River, property of the San Joaquin Light and Power Company, and arrangements made for their construction, but the plan of the large irrigation reservoir makes it impracticable to attempt any further efforts to perpetuate the run of salmon in the Merced River. With the completion of the Kerckhoff Dam and the proposed dam at Exchequer, the spawning grounds for salmon on the San Joaquin River and its tributaries are practically all cut off from the breeding salmon. During seasons of normal rainfall a few salmon will probably spawn near Friants, below Power House No. 4 of the San Joaquin Light and Power Company. This area is very small and would not have any effect in keeping up the run of salmon in the river.

An experimental salmon culture station is being established on the San Joaquin River with the object in view of determining what the expense will be of collecting the eggs near Friants in the fall and transporting them to the hatchery on Willow Creek, a distance of about thirty-five miles, hatching the eggs and rearing the fry in ponds, the fry to be held in the ponds until the following fall, then convey them by auto truck to the river below the Kerckhoff Dam.

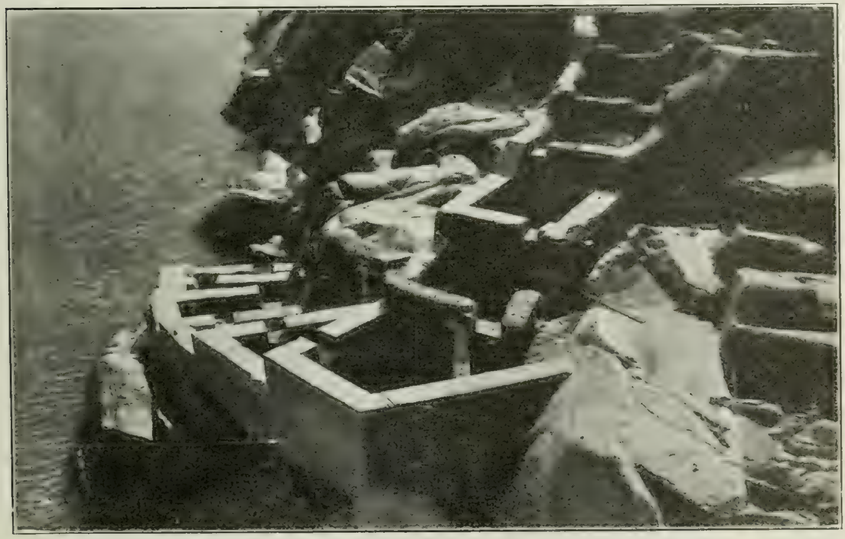

FIG. 23. Fishway while under construction at the Folsom Dam, on the American River. This fishway, recently completed, is one of the highest and best yet constructed in California. Photograph by A. E. Doney, October 24, 1919.

Two or three important features enter into this undertaking that will be the determining factor as to whether a successful salmon culture station can be established or not on the San Joaquin River. One is the expense of transporting the fry from the ponds to a point below the dams and the other is the screening of the large canals taking water from the San Joaquin River, from Friants to the diversion at the Temple Canal.

The expense on the transportation by auto truck of 2,000,000 or 3,000,000 fry each fall from the rearing ponds to the river below the dam should not stand in the way of keeping up this valuable supply of food fish for the people. A three-ton truck, with two men in charge, could transplant the fish in thirty days.

The river bed from this point to the Kerckhoff Dam, which diverts the water through a 17,000-foot tunnel, is dry during the summer and fall, as all the water is used for the operation of the power house. Under present conditions all the salmon that ascend past this point on the river, during the spring when the river is high, will pass the power house and lie in the pools between the power house and the dam for a distance of approximately fourteen miles. These will perish during the summer and fall when all the water of the river is diverted through the tunnel for power purposes. These fish cannot be saved at present, and very few are taken for food as the river from the dam to the power house flows through an almost impassable gorge, where few persons ever enter. If the plan of hatching the eggs at Willow Creek proves a success, racks will have to be placed across the river below the power house and the fish prevented from passing into the gorge.

There is a project started that will probably be completed during the next year or two, which consists of a high dam across the San Joaquin River at Friants to hold back the flood waters of the San Joaquin River for irrigation purposes. If this project goes through there will be no necessity for the racks as the salmon can be taken at the dam during the fall and their eggs collected and taken to the hatchery.

All of the above conditions must be carefully investigated and if it is practicable, plans must be made to save this valuable run of salmon on the San Joaquin River.

SALMON IN THE EEL RIVER.

The commercial fishing at the mouth of the Eel River and the spearing of the breeding salmon on the riffles on the upper reaches of the river necessitated the propagation of salmon in larger numbers on Eel River. Experimental work was carried on at an experimental station on Bull Creek, one of the tributaries of the South Fork of the Eel River and also in the main river near the mouth. The results of these experiments of the last three years have not justified the expense of establishing a permanent egg-collecting station on the lower reaches of the river.

There are several conditions on the lower reaches of the river that in our judgment makes it impracticable to establish an egg-collecting station in that region. The salmon when they enter the mouth of the river are compelled to remain in the large pond below Loleta until the river rises in the fall, as there is not enough water during the seasons of normal rainfall to allow the fish to pass over the wide, shallow riffles connecting the large pools from South Fork to the large pool at the mouth of the river.

As a rule the river rises to a considerable extent, but not before the majority of the salmon are caught by the commercial fishermen at the mouth of the river in the large pool. It has been suggested that eggs be collected from the fish in the large pool during the early fall before they ascend the river or are taken by the commercial fishermen but we find that the fish do not ripen in numbers great enough to justify the expense of seining them up and separating the few ripe ones from those that are green or immature. Furthermore, there is no water near the mouth of the river suitable for hatchery purposes. If eggs could be taken in sufficient quantities to justify the expense of collecting them they would have to be taken direct to Fort Seward Hatchery on the railroad, some sixty miles up the river. The eggs collected would in all probability be in such small lots that it would not pay to keep the necessary help and equipment.

Any attempt to place racks across the main Eel River or the South Fork, anywhere near its mouth, is almost impossible as the loose nature of the formation is not solid enough to hold the racks and, even if this were overcome, the tremendous amount of water that comes down Eel River during flood periods, carrying logs and debris of all kinds would make it impossible to retain any kind of a rack in the river. Furthermore, if a rack could be built that would stand the flood water of the river when the salmon were running, the number of fish that would be entering the river would be all fresh run from the ocean and would have to be held too long in order to have them mature.

An egg-collecting station on Eel River or its tributaries must be situated far up the stream, away from the tremendous floods and the floatage matter in the river, and must be in the upper reaches near the spawning grounds, where the fish have spent the necessary time in fresh water for the breeders to mature.

A careful examination has been made of the Eel River and its tributaries for a suitable site and an experimental station has been located near Branscomb on the South Fork of the Eel River in Mendocino County, about one hundred and twenty-five miles from the mouth of the main river. The material for the racks, trap, cabin and temporary hatchery were ordered with the expectation that the station could be finished this fall in time to catch the salmon run that ascends the South Fork, the principal spawning stream of the Eel River system, but the unusually heavy rainfall during November delayed the hauling of the material and caused the river to rise to such a height that it became impossible to complete the work. Plans are being made to finish the work next season and to carry on the experimental work at this station to determine whether there are enough breeding salmon in this reach of the river to justify the expense of establishing a permanent station at this place to collect eggs for the Fort Seward Hatchery. At this hatchery the eggs can be hatched and the fry reared to a suitable size to stock the Eel River and its tributaries.

It takes less fry to stock Eel River and maintain the run of salmon than any other river on the coast as there are few natural enemies of the young of the salmon to be found in the river. There are few predatory fishes, no diverting canals to carry off the water where fry are lost, or overflow basins, and very few water snakes or other natural enemies. If only a few million eggs can be collected and the resulting fry planted each season the run of salmon in Eel River can be easily maintained provided the fishing at the mouth of the river is regulated as well as the ocean fishing, where large numbers of salmon are taken each season.

In our judgment all net fishing should be prohibited in Eel River, as the salmon supply of that region will not stand for the heavy toll taken in the ocean as well as in the Eel River when the fish enter the fresh water to spawn. A law should be passed prohibiting all fishing in Eel River except by trolling. The steelhead trout would then have a better chance, as a considerable number of the adult fish are taken by the nets. The Eel River should be protected as a fish perserve to furnish both steelhead and salmon eggs for propagation.

Every precaution should be used by the Commission to prevent the introduction of any predaceous fish into the waters of Eel River as the stream is one of the few that can be depended on to furnish a large supply of steelhead as well as salmon eggs, if properly protected against too great a drain by commercial fishermen.

The commercial fisheries are increasing off the coast each season and the number of salmon taken in the ocean must surely lessen the number that enter the river to breed. As fish are in prime condition when taken from the salt water, fishing in the ocean should be allowed, but a restriction on the number that can be taken should be made. On the other hand, all net fishing in the Eel River should be prohibited.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

SOME CONSIDERATIONS CONCERNING THE SALTING OF FISH.

Mr. Donald K. Tressler of the Division of Fishery Industries, U. S. Bureau of Fisheries, has recently carried on some very interesting experiments on the salting of fish.* Mr. Tressler's work has to do chiefly with the fishes of New England and the Eastern coast, but a study of his work might be of benefit to the packers of the Pacific coast.

Previous to this time very little work had been done on this phase of the fishing industry. It required the stimulus of the enormous demand for food caused by the war to arouse an interest in fish salting and a demand for better methods. The purpose of these experiments was to work out, if possible, a method of salting fish applicable in warmer climates, 70 degrees Fahrenheit and above.

The standards of quality differ from place to place, some localities demanding a hard, dry, salted fish, while others want a white, colorless fish with a softer meat. Two methods of salting are now in common use on the Eastern coast, the dry or "tight packed" method and the brine or pickle method. The former method is almost universally used in the south and the other method in the north.

From a study of the procedure followed at the various places on the Atlantic Coast where fish are salted it would seem that there are perhaps three general methods of applying salt to the fish: (1) the fish are immersed in a solution of salt which is kept saturated, or nearly so, by the addition of salt from day to day; (2) the fish are packed in watertight containers with dry salt and are allowed to develop their own pickle;

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*Some considerations concerning the salting of fish. By Donald K. Tressler, U. S. Bur. Fisheries, Doc. 884 (1920), pp. 1-55.

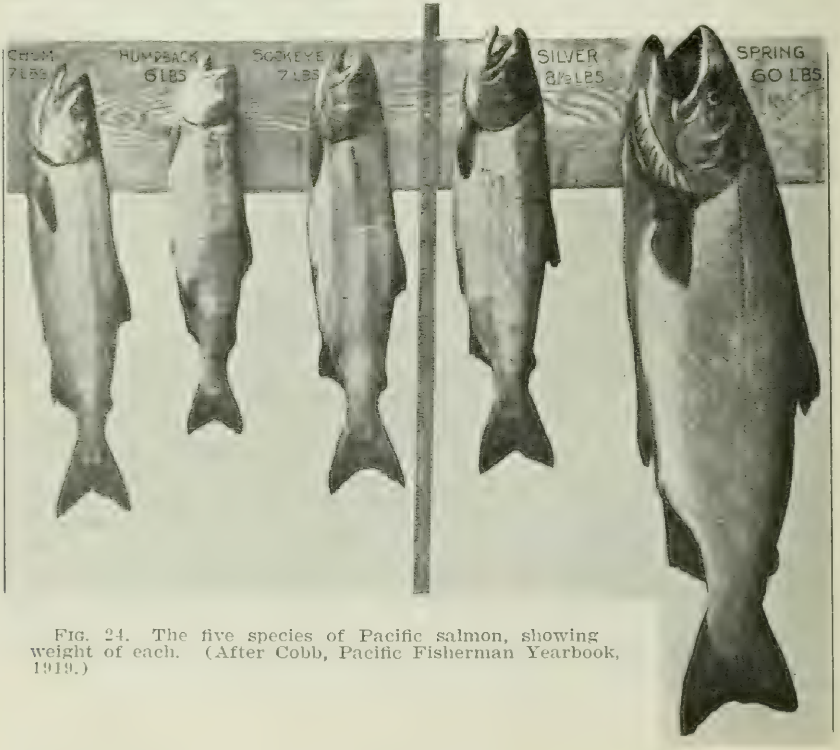

FIG. 24. The five species of Pacific salmon, showing weight of each. (After Cobb, Pacific Fisherman Yearbook, 1919.)

(3) the fish are packed in piles and the pickle allowed to run off the fish as it is formed. This last way is only used in cold weather in an emergency when no containers are at hand.

In storing of salt fish, these general methods are in use: (1) brine; (2) dry, with salt; (3) dry, with boracic acid. In case the first one is used, if the pickle becomes dirty, fresh pickle (salt solution) is added. New brine is always added if the fish are to be stored where it is not cool. If the fish are packed dry they are either sprinkled with dry salt or salt containing four-tenths per cent boracic acid. In all cases the fish must be kept at low temperature if stored for any length of time or they are very likely to "rust." "Rusting" is due to oxidation of the fish oil, giving the fish a dark-brown color. Packing in brine prevents this to a large extent.

Mr. Tressler has found that the impurities in salt exert a great influence on properties of the salted fish as to hardness, whiteness, etc. Pure salt is pure sodium chloride, but there are no salts on the market that are 100 per cent pure. Most American salt is of great purity. Calcium and magnesium salts and sulphates as impurities in salt retard the penetration of the salt into the fish. The investigator also found the following things to be true: That fish packed in dry salt, without the addition of brine, may be kept at a higher temperature than fish salted in brine; the removal of all blood and viscera, including milt and roe, is absolutely essential for the salting of fish at high temperatures; and that during warm weather freshness of fish is essential to successful salting.

From the results obtained by Mr. Tressler, it seems very probable that fresh fish may be salted in any climate of the United States if the following precautions are taken:

1. All viscera and blood must be removed in cleaning.
2. Large fish must be split.
3. Fish must be salted in reasonably fresh condition.
4. No brine should be added in salting.
5. Salts low in calcium must be used.

—A. W. Wells, *Bureau of Fisheries Preservation Laboratory.*

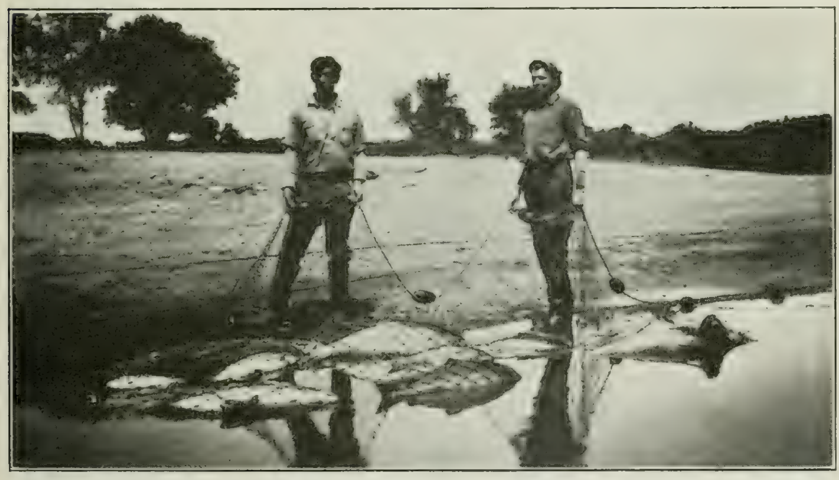

FIG. 25. Seining for salmon on the Sacramento River near William's Bar. Photograph by R. B. Heacock, April, 1916.

SALMON CONSERVATION AND SALMON TROLLING.

The commercial method of catching salmon by trolling is described in an article by W. L. Scofield in this issue. The catching of salmon by this method has now become an industry of great importance to this state, Oregon, Washington and Alaska. The principal trolling districts in this state are in Monterey

Bay, off San Francisco and near Fort Bragg, Mendocino County. At each of these places about five hundred boats were employed this year. Before sea trolling became important in California salmon were nearly all caught by means of nets in the rivers which they enter at maturity for the purpose of spawning. To show the catch by these two methods we give the following from an article on "Ocean and Stream Salmon Catches," in the October issue of this magazine:

Total Yearly Salmon Catch of the State in Round Numbers.

	River caught	Ocean caught	Season total
1919	5,987,000	7,158,000	13,145,000
1918	7,173,000	5,920,000	13,093,000
1917	5,493,000	5,563,000	11,056,000
1916	5,342,000	5,501,000	10,843,000

The salmon caught in Monterey Bay, off San Francisco and in the Sacramento River are generally classed together as a unit under the assumption that they are the product of the Sacramento River. The following table shows the catch by trolling in these two outside regions contrasted with the catch by nets in the river:

	Monterey Bay	Outside San Francisco Bay
1919	2,816,000	1,443,000
1918	2,893,000	1,929,000
1917	3,880,000	1,280,000
1916	5,231,000	263,000

	Troll fish	Sacramento River
1919	4,259,000	4,529,000
1918	4,822,000	5,938,000
1917	5,160,000	3,971,000
1916	5,494,000	3,451,000

It will be seen that the Monterey Bay catch has been falling off. Contrasted with this is the catch in the Fort Bragg region which has steadily increased due

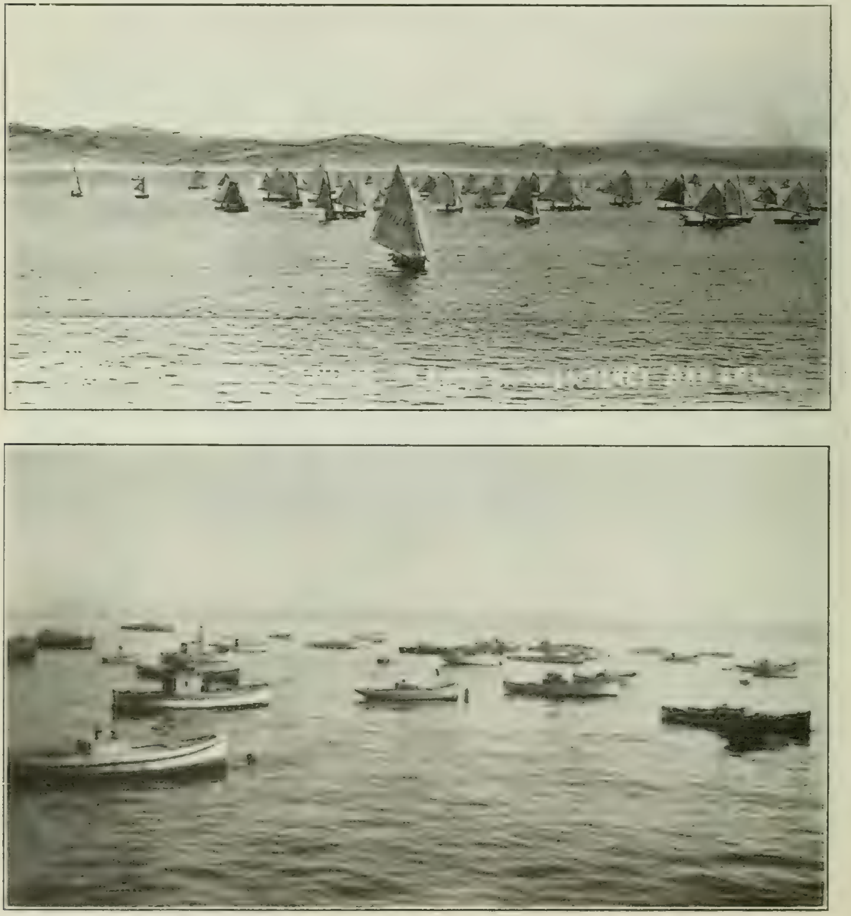

FIG. 26. The Monterey salmon fleet of fifteen years ago is now entirely replaced with power boats.

to the recent development of the industry at that point. The catch near Fort Bragg was less than half a million pounds in 1917, in 1918 it exceeded one million pounds, in 1919 it was a little less than three million pounds, and this year the catch exceeded three million pounds.

This catching of the salmon in the open sea has added greatly to the difficulties of conserving these valuable fish. Our state laws provide for closed seasons on all of our salmon streams during which time salmon may not be caught. These closed seasons were mostly established before the development of sea trolling and were designed to allow at least one-third of the fish to pass up the rivers to the spawning beds unhindered by nets, under the belief that if this portion of the run, together with the number which escape the nets during the open season, could reach the spawning beds the run would be maintained. If these closed seasons let just enough salmon reach the spawning beds for the perpetuation of the species, then the additional catching of the fish by trolling in the sea before they enter the rivers will be subjecting them to just that much overfishing, for if one-half of the run, we will say, is caught in the sea before it enters the river, the river closed season, instead of protecting one-third of the run as intended, protects only one-sixth of it. It is our belief that the closed seasons on the Sacramento River were not sufficient for the purposes of propagation even before sea trolling came into general practice. The fall season, instead of closing before the latter third of the run has entered the upper bays, does not close until after the last salmon are well up the river and no portion of the run escapes running the gauntlet of nets. This insufficient closed season, coupled with the increase of trolling at Monterey and off San Francisco, has resulted in a decrease in abundance of the Sacramento salmon. This decrease in abundance is shown in the fact that the number of salmon which reach the egg-collecting stations of the United States Bureau of Fisheries on the upper Sacramento River averages less than one-half that of a few years ago. At the same time, in spite of more energetic fishing, the commercial catch has not increased, even if we consider all the salmon caught in Monterey Bay and off San Francisco as Sacramento fish. There is no question but that the Sacramento salmon need decidedly more protection if we are to save these fish from destruction. This need of added protection has been increased by a decision of the Superior Court of Contra Costa County which permits fishermen to net salmon on Suisun Bay and the lower Sacramento River during the summer closed season of June and July; and also by irrigation and power dams under construction and to be built which will shut off important salmon-spawning grounds lying above them.

Fishermen who fish with nets on the bays and rivers think that the sea trolling should be stopped or radically restricted, contending that the trollers are destroying the salmon by catching large numbers of immature fish. Salmon trollers, on the other hand, contend that the sea is the proper place to catch them and that after they have entered the river for the purpose of spawning they should not be caught. There is considerable merit to the arguments on both sides of this question. We are convinced that both methods of fishing need to be radically restricted, and that the time is now here when the laws should be made so as to best conserve the salmon and should not be compromised to suit different factions of fishermen on the plea that the state owes them a living. Salmon on the Sacramento need far more protection than they are getting under the present law, even if sea trolling is greatly restricted. Netting of salmon should not be permitted above the city of Sacramento, the summer closed season of June and July should be restored, and the fall closed season should close two weeks earlier.

It is true that a great many of the salmon caught by trolling are immature as is well shown in the paper on the "Relative Maturity of Salmon Caught by Trolling," in this issue, by Willis Rich. From investigations which have been made it is not clear that trolling is a more destructive method of fishing than is netting in the river. There are evidences which indicate that a salmon fishery may produce more pounds without depleting the supply if the fishing is carried on only in the sea. It is our belief, however, that until our investigations throw more light on this subject, closed seasons should be established in the trolling districts during those times of the year when the majority of the immature fish are caught. These restrictions should not be so severe as to discourage the development of our sea fisheries, for the future expansion of our fisheries must be through sea fishing as our inland fisheries are now being taxed to their utmost capacity. Sea trolling for salmon, we believe, should be encouraged, for it is the most promising avenue through which sea fishing for other varieties of fish may be developed in the northern half of the state. The inauguration of salmon trolling a few years ago near Fort Bragg has resulted in fishing for other varieties of fish and it can be confidently predicted that within a few years we will have other fisheries there of more importance than the salmon.

EEL RIVER PROBLEMS

Just as the catching of salmon of the sea has been an added drain on the Sacramento salmon, so is the recent rapid growth of salmon trolling near Fort Bragg an added drain on the Eel River salmon, and fish of that river are in need of additional protection. This ocean catch is apparently having little effect on the run in the Klamath River, which is more than one hundred miles to the north.

It seems impossible to devise an open season for nets on Eel River which will satisfy the needs of the sportsmen, the commercial fishermen and the salmon culturist, and at the same time properly conserve the two species of salmon and the steelheads which spawn in the river. The Quinnat salmon begin entering the river early in September, and as there is rarely sufficient water before November to permit them to get above the pools near the mouth, these fish remain there in the fresh water and after a time become of little value for food, although they are still of value for propagation purposes. If the netting season is opened early and closed early so as to let the latter part of the run ascend the river unhindered to the spawning beds, and so as to take these early salmon while they are still fit for food, it meets with the violent opposition of the sportsmen, who contend that it would ruin their steelhead fishing which is carried on in the lower river before the winter rains. If the open season for nets is moved to a time sufficiently late to permit these salmon lying in the pools to ascend the river beyond the reach of the nets, too many spawning steelheads and silver salmon, which begin entering the river about the first of November, would be taken. The present netting season of October 8 to December 7, inclusive, was a compromise season designed to meet the conservation requirements of the two species of salmon and the steelhead, and to partially satisfy the sportsmen and commercial fishermen. This open season has not satisfied the sportsmen or the commercial fisherman, and it has not met the needs of the salmon culturists; and, on account of the development of outside trolling, it does not meet the conservation needs of the Quinnat salmon.

The season is not sufficiently early to take the first part of the run before the fish become inferior for food purposes and it closes too late to let a sufficient number of fish reach the spawning beds up the river. On account of the depletion of the Sacramento run, salmon eggs can no longer be taken from that river to be used in stocking Eel River. If salmon culture is to be carried on in Eel River, the river must furnish its own eggs. Salmon racks can not be maintained in those parts of the river which are suitable for taking salmon for propagation purposes after the river is in flood, and it appears that the only feasible way in which eggs can be taken for this purpose is to permit the first of the run to ascend to the salmon racks after the first rise in the river, which is usually not sufficient to wash out the racks. If the netting season is placed sufficiently late to come after the first rise in the river and closes sufficiently early to avoid taking too many of the late running silver salmon—which date should not be later than December 1—the season would hardly be long enough to make netting profitable. We see no good way of harmonizing these varied interests. Whatever is done it should be seen to that the conservation needs of the three species of fish involved get first consideration.

NOTES FROM THE STATE FISHERIES LABORATORY.*

WILL F. THOMPSON, Editor.

CHANGES IN THE PERSONNEL.

Since the appearance of the last number of this magazine there have been several changes in the staff engaged in fisheries research.

Mr. John W. Rich, who has acted as field assistant in the albacore work at San Diego and San Pedro during the summer of 1920, has returned to Pomona College to resume his studies.

Mr. O. E. Sette, who has been with the Commission for more than a year, has also returned to his college work, having left for Stanford on September 1. He was stationed at Monterey observing the sardine fishery during the fall and winter fishing seasons, leaving there to act as field assistant at San Pedro in the work on the albacore during the summer months. At Stanford he will take up the study of subjects bearing on fisheries research and will at the same time prepare for publication the sardine data which he has collected. The Commission is fortunate in being able to retain the interest and services of Mr. Sette, whose work has been of high order.

To take the places of Mr. Sette and Mr. Rich, Mr. W. L. Scofield and Mr. Harlan B. Holmes have been added to the personnel of the laboratory. Mr. Scofield had been previously employed in research on the salmon and has been transferred to that on the sardine. He will be stationed at the Hopkins Marine Station in Monterey during the coming season, to carry forward the work already done by Mr. Sette. He is known to the readers of CALIFORNIA FISH AND GAME for several contributions made in past issues. Mr. Holmes has been a student at the University of Oregon, at Eugene; comes highly recommended, and with good training in biological work. He will be stationed at San Pedro, and will be engaged in the sardine work in company with Mr. Higgins.

Mr. Thompson will remain in general charge of the work, with temporary headquarters at Monterey. Mr. Higgins will remain at San Pedro.

Professor Weymouth, who has been engaged for several months in research on the Pismo clam, leaves on December 15 for Stanford University, where he will resume his teaching in physiology. He has one paper now in the hands of the printer and another in the process of writing. His work on the Pismo clam will prove of considerable value because of the great interest taken by the public in the preservation of that species, and because his work will prove of fundamental importance in the study of other mollusks.

THE SARDINE SEASON.

The sardine season opens inauspiciously this year, and it seems to be a serious question whether enough material will be obtained to complete our program of investigation for this year. No sardines were being taken at San Pedro at the time this note was written—December 8—and there was little hope held out by the cannerymen that very extensive packing would be resumed at any near date. At Monterey a number of the canneries have ceased operations, but up to the present at least no difficulty has been experienced in obtaining sufficient fish for our purposes.

What will happen in the future is not at present clear. There is no lack of fish at Monterey, and there is no reason to believe that they would be lacking at San Pedro if sought for. The reasons for the failure of the canneries to operate are given as a lack of orders, due very largely to the slump in export trade, and to the expectation of a falling market for sardines.

The sardine investigation, however, will not suffer vitally, even though the program for this year be disrupted, as there are enough data on hand to take considerable time in handling and interpreting. This program has been dealt with in the last issue of CALIFORNIA FISH AND GAME (Volume 6, No. 4, page 180).

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*California State Fisheries Laboratory, Contribution No. 23.

CONFERENCES ON THE SARDINE WORK.

In order that the various assistants engaged in work on the sardine may thoroughly understand the program, we have instituted a system of conferences, in which the men engaged at Monterey and San Pedro meet as often as necessary, or more often if possible. The last conference was on the twenty-sixth and twenty-seventh of November, when Mr. Thompson, Mr. Weymouth, Mr. Sette, Mr. W. L. Scofield and Mr. Holmes were present. The purpose in this as on preceding occasions was to correlate the programs and to give everyone a thorough knowledge of them.

These conferences are inevitable because of the necessity we are under of educating the new assistants as they come, and of giving them an understanding of the fundamental reasons for the program we have adopted, if for no other cause. It is our hope that these assistants will be able—after the lapse of several years—to each take over entirely certain phases of the sardine or other problems, and to do this a thorough schooling is necessary. It has become obvious that a merely mechanical execution of duties by a more or less disinterested subordinate will not solve any of our fishery problems, and therefore we hope to give each worker a show in the rewards and penalties which come to the research man.

The inevitable period of training must include work under the senior assistants, but as fast as it is possible to place every investigator on a separate problem to make his own report this will be done, for it is recognized that no man works as well for another as for himself, and that there is no incentive comparable to that of professional success for which full credit is received. But until a thorough knowledge of the fundamentals is obtained such a course would be disastrous to any assistant, and hence the necessity of education.

The more immediate aim is, however, to have a discussion of all that bears on our problems and to make sure that the investigations at Monterey and San Pedro supplement and parallel each other where necessary. These conferences already held have proved of the utmost value in formulating the programs of work, avoiding mistakes, and bringing to everyone's attention the observations made.—W. F. T.

THE PROGRESS OF THE NEW LABORATORY.

The building of the new laboratory at San Pedro has been definitely decided upon by the Commissioners, and the State Architect, Mr. McDougall, has the matter in hand. It is sincerely to be hoped that the building will be rushed, as we will face an embarrassing situation in the near future when the sardines begin to be taken at San Pedro, in that we will have to ask quarters from some cannery for our operations, the temperary laboratory being too far removed.

To those interested in the purposes of the new laboratory the statement concerning them in the last issue of California Fish and Game, Volume 6, No. 4, page 177, will be of value.

THE HABITS OF SEA GULLS.

It is not an uncommon thing to have the presence of small fish in quantity regarded as the reason for the presence of great numbers of sea birds, especially sea gulls, at certain localities. Observation at Monterey has shown, however, that the great flocks of sea gulls frequently seen there during the winter occasionally appear on the days following a severe blow or other weather disturbance. This has not been investigated enough, however, to justify a positive statement, yet is highly suggestive in throwing light upon the belief mentioned as to their connection with the presence of young fish. The visits of the great flocks would seem to be due to the rough surf or wind on the outer coasts, when they are not present in both places in numbers during their migration.

That sea gulls are very sensitive to the condition of the water is strongly implied by an observation we have made upon them at Monterey. This observation has been repeated so often by laboratory members working there as to be beyond doubt. The water off such a lee shore as at Monterey is frequently streaked with light and dark areas, the light areas being smoother and reflecting the sky more perfectly. These smooth light areas are always strictly avoided by the sea gulls (chiefly herring, western and glaucous-winged) for some reason, the flocks of gulls at rest on the water being invariably and sharply limited by the roughened dark water. This distribution of the flocks upon the water is for the purpose of resting, not feeding, and is invariable and exact. It is a most remarkable and strange fact. Whether the rough areas are caused by winds running counter to the currents or otherwise, the choice of such surfaces as resting places indicates unmistakably the sensitiveness of the gulls to the condition of the water, and thus throws some doubt upon the presence of food as the factor determining their presence.—W. F. T.

A FURTHER NOTE ON THE MONTEREY GULLS.

In the April, 1920, number (page 85) of California Fish and Game, in an article on the "Gulls in Monterey Bay," it is pointed out that these birds, although diurnal in habit, were on one occasion observed to be feeding at night on sardines lost overboard while the lighters were being unloaded at the canneries. Such cases of night feeding are evidently not rare, for gulls in great numbers have been noticed recently on two occasions flying about the lighters in search of chance sardines dropped overboard. On one occasion the gulls were flying half an hour before daylight. The usual habit of the gulls is to spend the night on their roosting grounds, supposedly along the coast, and to appear suddenly at the canneries in large numbers with a regularity as to time that suggests an alarm clock, the time being just before daylight and considerably before sunrise. On the mornings when this sudden appearance was timed it was found to vary but a few minutes from the scheduled breakfasting hour for Monterey gulls. On one other occasion gulls were noticed in large numbers at 10.30 p.m. (November 28) in bright moonlight flying about the sardine lighters. Fishermen and cannerymen say that the gulls have learned that the chances for a square meal are good whenever the sardines are being delivered to the cannery, and that it is no uncommon sight on moonlight nights to see hundreds of gulls flying about on the outlook for stray sardines. Just what amount of fish a gull considers to be a square meal is a question. One gull has been observed to swallow four large sardines in rapid succession and then fly off with ease. If the supply of sardines holds out more are swallowed until the bird is so weighted down that he is unable to fly, and must perforce walk or swim away to some quiet spot where the meal may be digested undisturbed. If confronted with the necessity of flying out of danger, the gull must lighten ship by disgorging his meal before taking to the air. Occasionally the sardine fishermen leave a lighter full of fish uncovered and unguarded, in which case gulls gather in the boat and eat until they are helpless. On the return of the fishermen the overloaded gulls allow themselves to be picked up and thrown overboard rather than disgorge away part of the feast. On one such occasion 65 gulls filled to capacity were counted as they were thrown into the air from a lighter and came down with a splash into the water. After a few feeble attempts to rise from the water these contented gulls swam off sedately, all headed for a sheltered stretch of sunny beach.—W. L. S.

LIFE HISTORY NOTES.

OPOSSUM KILLED ON MOUNT HAMILTON.

Last night I killed a porch climber, in the shape of an opossum (*Didelphis virginiana*), here on Mount Hamilton. A few years ago a number of these animals were turned loose, or escaped, near San Jose, and they have since become established in the Santa Clara Valley. I was somewhat surprised, however, to find one at this distance from the original point of importation.

Mount Hamilton is at the summit of the range bounding the Santa Clara Valley on the east, and lies about thirteen miles, in an air line, from San Jose. It is separated from the Santa Clara Valley by two deeply cut watersheds: Halls Valley and Smith Creek. If the species keeps up its present rate of travel, it will be in the San Joaquin Valley within a few years, and from there will doubtless spread rapidly over the state. From the havoc this one created in the grapevine that marked the end of his particular trail, his relatives will not be very welcome guests to the vineyardists and other fruit men of the state.—W. H. WRIGHT, *Mount Hamilton, California.*

THREE MOUNTAIN LION KITTENS CAPTURED.

About September 1, 1920, reports came to the Fish and Game Commission that there were mountain lions in the vicinity of Cathey Ranch, near Jerseydale, Mariposa County. I was sent to hunt the lions. I arrived at Jerseydale on September 10, and learned then that the lions had been heard screaming near the Cathey Ranch.

Never having heard the so-called scream of the mountain lion, and, in fact, having found them to be an invariably silent animal, I was much disappointed with this report. However, I spent two days hunting in the vicinity of Jerseydale without finding any sign of lions.

In the meantime, I telephoned to Ranger Malcolm McLeod and learned that cattle men had reported that they had seen some lion tracks several times on Owl Creek, near Devil's Gulch, eight miles northeast of Jerseydale. On the evening of September 12, I moved my outfit to the Mariposa Ranger's Station and the next day, while Ranger McLeod packed my equipment to camp on Owl Creek, I hunted on the way over to the

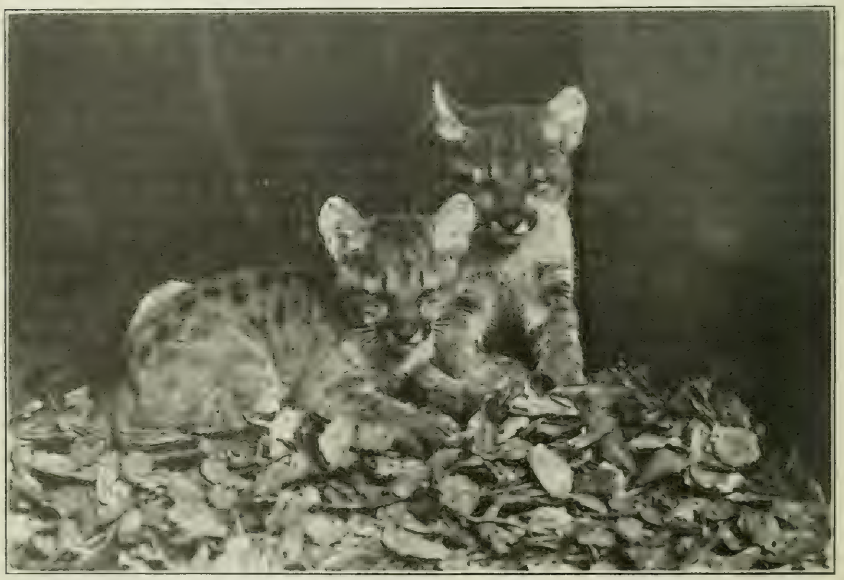

FIG. 27. Mountain lion kittens captured by Jay Bruce, state mountain lion hunter, in Mariposa County, September, 1920. Photograph by H. C. Bryant.

camp, then down the ridge on the east side of Owl Creek, and then to the east up Devil's Gulch and back to camp. I found old tracks of a female lion near the mouth of Owl Creek and in Devil's Gulch, but the indications were that the lioness had not been working these for several days.

The next day, September 14, I started to hunt in the country west of Owl's Creek, and about 7 a.m. my dogs picked up the fresh trail of the lioness going east toward Owl Creek. After trailing about half a mile my silent trailer, Ely, who was about two hundred yards in the lead of Ranger, the hound, jumped the lioness, which was indicated by Ely's barking.

The lioness ran down Owl Creek, going north for about a quarter of a mile, then treed in a live oak. I noticed that when Ranger arrived at the place where Ely found the lioness, he became confused for a few moments before straightening out the trail, but I was taking a short cut to where Ely was barking "treed" so that at the time I did not learn the cause of Ranger's confusion.

After shooting the lioness, the first thing that I noticed was that she had just been nursing kittens, as her breasts were still wet.

I skinned the lioness and afterwards back-trailed her tracks over the course that the dogs had chased her. When I reached the place where Ely had found the lioness, I noticed her fresh tracks going on toward Owl Creek and returning again over the same course; this explained why the hound had gotten confused.

The next thing was to find the kittens. After searching the brush and rocks for several minutes without success, and having in mind the track I had noticed going east from here and returning the same way, I decided that the kittens were somewhere farther east. Evidently, while the mother lion was nursing the kittens she heard the hound baying on her trail, about a quarter of a mile away, and left the kittens and back-trailed herself to meet the dog, but she was surprised by the silent dog, who was in the lead of the hound. Then she turned at right angles and led the dogs down the creek and away from the kittens. I now followed her tracks for about five hundred feet east and across Owl Creek to a bluff of rocks, where the dogs scented the kittens, which were hiding in the small holes among the rocks. Two of the kittens were in one place and the other was about twenty-five feet from them in another hole. After considerable trouble I captured the kittens alive, and after taking off my shirt I carried them in it for about a mile to camp. From the camp I carried them in a barley sack for five miles to the Ranger's Station and then from there by auto to the office of the Fish and Game Commission in San Francisco.

The kittens were about six weeks old and were the size of an adult house cat. They weighed about eight pounds each and were twenty-six inches in length from tip to tip.

The home of the lions was on a ledge about seventy-five feet from the water of Owl Creek and near the top of a bluff of rock. This ledge, which was about sixty feet above the base of the bluff, was about five feet wide and extended about thirty feet along the north side and the same approximate distance along the west side of the bluff. Although there was no cave or den large enough to shelter the mother lion, this was apparently the place where the kittens were born and where they had lived until they were captured; as there were numerous beds, both on the north and west sides of the bluff, where the lioness had been lying on the ledge. The dry grass and moss all along the ledge was well worn and trampled, probably by the kittens while playing. The small holes among the loose rocks behind and above the ledge had evidently provided hiding places for the kittens when disturbed.—Jay C. Bruce, *Oakland, California.*

HOW MANY EGGS DOES A SALMON LAY?

In the course of a study of King Salmon in Klamath River, it became desirable to learn how many eggs the female produces. Thinking that it may be of general interest, a table including the results of an examination of 30 individuals is given, the specimens being selected from a larger number as fairly representing the average.

Klamath salmon are somewhat smaller than those of the Sacramento, and it is possible that the females produce fewer eggs. In a series of 3350 Klamath salmon the smallest female measured 20 inches and the largest 42. One either smaller or larger is rarely found.

The number of eggs here given were obtained not by actual count, but by weighing the ovaries, counting a small number of eggs, weighing the latter, and then calculating the entire number. Tests demonstrated that the method gave results accurate to 1 to 3 eggs in a 100. Ovaries from the same fish are not usually alike in size, the left being often somewhat larger than the right and containing as many as 200 or 300 more eggs. No very definite relation is seen between size, weight, or age and the number of eggs, although it will be noted that fish in the fifth year are found amongst those having most eggs.

Number of eggs	Length, inches	Weight, pounds	Age
2146	26½	8⅛	4
2709	31	11¾	4
2745	31½	14¼	4
2847	30¼	12¼	4
2879	28¼	9¼	4
2949	30¼	13¼	4
3083	31½	15	4
3110	33¼	17⅝	4
3200	32¼	16½	4
3305	28	10½	4
3403	31	13½	4
3467	32	15	4
3579	27	9½	4
3586	29½	12⅛	4
3614	32½	14	4
3630	32½	15⅜	--
3672	32	13⅝	4
3676	32½	15⅜	4
3731	33	17½	4
3781	32¼	14½	4
3886	30¾	13	4
3935	33	15½	5
4009	31½	14	4
4117	37½	26½	5
4192	32½	17¼	4
4197	30½	13¼	4
4200	34¼	19⅛	5
4300	32¼	15⅝	4
4392	34¼	16⅜	5
4842	34¼	18	5

Average number of eggs per fish, 3572.
—J. O. SNYDER, *Stanford University, California.*

FULVOUS TREE-DUCK SHOT NEAR COLUSA.

On October 16, 1920, while shooting ducks seven miles north of Colusa, the writer saw a flock of about twenty birds which came to the pond several times which were to him unknown. One of these birds was shot so that it might be identified, but when examined none of the party were able to name the bird. While discussing the specimen, Fish and Game Deputy Wm. N. Dirks happened by and identified it as a fulvous tree-duck. *Dendrocygna bicolor.* It was in fine plumage and is of particular interest because it is unusual for one to be seen so far north and at so late a date.—A. C. HANSEN, *Birds' Landing, California.*

BLACK FISH NEAR SANTA CATALINA ISLAND.

While doing patrol duty with the "Albacore," on November 18, 1920, I came upon a school of black fish (*Globiocephalus scamoni*) near Santa Catalina Island, about ten miles north of Lone Point. I estimated that there were about one hundred individuals ranging between thirty and forty feet in length. They were going slowly northward. Unfortunately, I was unable to secure a specimen.

This large, porpoise-like mammal was formerly abundant off the coast of lower California and in the Gulf of California, but in more recent years it is not often seen. An oil made from the head of the black fish is highly prized for use in watches and chronometers. This oil is said to improve with age.—H. B. NIDEVER, *San Pedro, California.*

CONSERVATION IN OTHER STATES.

SANCTUARY FOR WILD LIFE DEEDED TO LOUISIANA.

A tract of land embracing 224,000 acres in Louisiana has been set aside as a perpetual bird sanctuary, and secondarily as a refuge for game, thus bringing to fruition the project of Edward Avery McIlhenny.

On November 8, 1920, deeds were signed in the office of the State Conservation Commissioner which gave to the state in fee simple Marsh Island, 79,300 acres in extent, which was purchased and presented by Mrs. Russell Sage; the Grand Chenier tract, 85,000 acres, purchased and presented by the Rockefeller Foundation, and the Ward-McIlhenny tract, 60,000 acres.

Years ago the plan for this reservation was thought out by Mr. McIlhenny, who first discussed the proposition with a friend, Charles Willis Ward. Mr. Ward supported the idea and as a result the Ward-McIlhenny tract was set aside as a wild life refuge. Mr. McIlhenny, encouraged in his plan to secure an adequate sanctuary for native and migratory birds, found a willing helper in Mrs. Sage. Soon afterwards he secured the appropriation from the Rockefeller Foundation and now the reservation is definitely assured to the state.

The Marsh Island tract lies in the Gulf of Mexico, off the coast of Iberia, St. Mary and Vermillion parishes; its eastern shores are famous as migratory bird haunts. The Grand Chenier tract is on the mainland and adjoins the Ward-McIlhenny tract and is close to Marsh Island. The Marsh Island and Grand Chenier tracts have been under the care of Commissioner Alexander of the State of Louisiana for the past six years, and this supervision has been so successful that it was finally decided to turn them over in fee simple to the state, along with the Ward-McIlhenny tract.

In the event of the discovery of any valuable ore or mineral, it is to be removed with the least possible disturbance to the wild life and the profits accrued must be used to further the protection of it, and if more money is made from this source than is needed for its original purpose, it is to be devoted to education or public health in the state.

VERMONT ESTABLISHES SANCTUARY FOR WATERFOWL.

The Vermont Fish and Game Commission has secured an option upon a tract of 900 acres of marsh land at the mouth of the Lamoille River, on Lake Champlain, as a sanctuary for waterfowl in their trips north and south through this much traveled migration route. The area has been investigated as to its properties for feeding the birds by the U. S. Bureau of Biological Survey and is considered ideal. It is expected that enough revenue can be derived from the trapping privileges to pay the salary of a caretaker; for the region abounds in muskrats, skunks, and other fur-bearing animals. This step is the first of its kind taken in any of the northeastern states.—*The Conservationist*, June, 1920.

VALUE OF PENNSYLVANIA'S ANNUAL KILL OF GAME.

The State Game Commissioner of Pennsylvania, John M. Phillips, through the statistics of the State Commission, estimated that there were 6,000,000 pounds of meat bagged as game last year which, at 20 cents a pound, would have a value of $1,200,000. Three thousand buck deer were killed and 472 black bear. Mr. Phillips estimates that next year there will be 4000 deer killed and that the total weight of the game killed, including all smaller game, will be at least 8,000,000 pounds, which, at 20 cents, would be $1,600,000.—*Field and Stream*, September, 1920.

QUEBEC LICENSES FUR DEALERS.

Canada is following the United States in the effort to conserve fur-bearing mammals. Recently, the province of Quebec took over entire control of its fur trade. Fur traders must take out licenses and report monthly all furs bought. The government imposes a small royalty on all skins before they can be stamped, and no unstamped skin may be sold or shipped out of the province on penalty of confiscation and fine. Trapping out of season is to be controlled, for obviously no inspector will stamp a skin which shows evidence of having been taken out of season. All shipments of skins not plainly marked on the outside will be confiscated and the sender fined. Thus, the poacher will be unable to market his illegally taken fur.

AUTOMOBILES CONFISCATED IN WISCONSIN.

The state of Wisconsin has a law which imposes on hunting violators not only a $50 fine, but deprives these men of their guns, hunting licenses and automobiles. The confiscation of the automobile is a drastic and effective step, for it affords a stronger protection to the partridges and prairie chickens, which must be protected against the onslaughts of those who previously have been willing to "take a chance." They are more apt to think now what it will mean if they are caught.

THE SYSTEM OF CONSERVATION IN PENNSYLVANIA.

In an article published in the Bulletin of the American Game Protective Association, Mr. Holland states that the basis of the game protective system adopted by Pennsylvania is a combination of public shooting grounds and game refuges.

The first game preserve was established in Pennsylvania in 1905, and—quoting from Mr. Holland's report—"at the present time the state has twenty-four state game preserves, eighteen being on state owned forest lands and six on leased land that will eventually be owned by the state. These preserves are approximately nine miles in circumference and individually contain from 1700 to 3200 acres. Around each preserve are from 3000 to 7000 acres of land that is public shooting ground, on which any man may go and shoot, provided he complies with the laws of state and nation." According to the state laws, one-half of the total acreage of the state can be utilized in this way.

The game refuges have been placed as near as possible to the centers of population and in the center of state-owned forest lands, which during the open season constitute the public shooting ground. By this method the game is more readily protected when out of season. The preserves can not be mistaken, for a wire stretched waist high surrounds it, and often as many as six refuge posters can be seen from one point along the reserve. Too, fire protection clearings surround each area. The average cost of establishing a refuge is $2,175, and the yearly cost of maintaining the preserves total about $1,174.

Aside from the larger preserves, there are the auxiliary state game preserves, which "are tracts of land, generally of 250 acres or more. They are cared for by the state, but are owned by some individual or a group of several individuals who are willing to donate or lease the land to the state as a game preserve for a period of ten or more years. A part of each tract is posted and cared for by the state and the balance is used for public shooting. These reservations may consist of farm lands. The plan has been found very beneficial where small game such as quail and rabbit are concerned."

The system of protection practiced in Pennsylvania to assure to the sportsmen an abundant supply of game seems to be eminently successful, and by 1921 Pennsylvania plans to have increased the number of her game preserves to forty.

THE PLATFORM ADOPTED BY THE ILLINOIS SPORTSMEN'S LEAGUE.

The annual meeting of the Illinois Sportsmen's League was held at Belleville, Ill., on May 14, 1920, and quoting from the Illinois Sportsman, the official organ of the League, the program which they are to support follows. It will be noted that the organization still maintains that the Federal Migratory Bird Treaty Act does not give the middle West a fair deal so far as duck hunting is concerned:

First—We are for the enactment of just and equitable game and fish laws and the vigorous and impartial enforcement of the same.

Second—We favor a program which will result in a better understanding between the farmer and sportsman.

Third—We feel that the number of game and fish wardens is inadequate and stand for an increase, also insist that efficient service be given at all times.

Fourth—Since the revenue from the sale of hunting and fishing licenses receipts for fines, etc., more than pays the operating expenses of the Illinois Division of Game and Fish, we ask that this surplus be kept intact in a special fund to be used for the conservation of our wild life.

Fifth—We stand for such an increase in game and fish as will furnish legitimate sport for every citizen.

Sixth—We favor the establishment by the state of recreation grounds which will be open to the public at all times for either hunting, fishing, camping or other outdoor life sports.

Seventh—We will give our support to the Illinois Natural History Survey and State Forester in the preliminary work now being done for the conservation of what is left of our natural forests.

Eighth—We stand for a system of game refuges, and resting places for waterfowl; that is, in case public shooting grounds are obtained by the state, certain portions thereof shall be set apart where game can breed and raise its young without being molested by hunters, following the Pennsylvania plan.

Ninth—We stand for an extension of the fish rescue work now being done by the state, and feel that this could be made much more effective by the purchase or lease of certain lakes to be used for placing the smaller fish taken from the shallow bodies of water. When larger these fish could then be taken out and distributed for stocking purposes.

Tenth—We stand for a reduction in the bag and possession limits on all of our game birds and animals, this to be determined after a free discussion of the subject through the medium of this organization.

Eleventh—We stand for a change in the open season for the taking of our furbearing animals, preferably from November 15 to February 15.

Twelfth—We stand for a change in the open season on rabbits, preferably from November 10 to January 31; and in addition thereto believe a possession limit should be fixed. By delaying the opening of the rabbit season and making it the first day of the open season for quail, there is a general feeling among the true sportsmen that many quail will be saved.

Thirteenth—Millions of dollars are being appropriated by the General Assembly at each session for the good of the people, therefore we are of the opinion that the question of establishing state parks should be given some consideration along this line. Next year we propose asking for a liberal appropriation, and request the cooperation of the people in general in obtaining the same.

Fourteenth—We consider roving dogs and cats one of the greatest existing menaces to our wild game animals and birds during the breeding season, therefore we favor the enactment of a law regulating the same.

Fifteenth—We stand for an amendment to the existing laws which will give the state additional powers in dealing with the pollution of the rivers and other streams of our state causing the destruction of our fish.

Sixteenth—The Migratory Bird Treaty Act has been upheld by the United States Supreme Court, therefore, it is the supreme law of the land, so the safe plan is to obey the same; however, we still maintain that the Middle West states are entitled to a late winter season during February and March for the shooting of waterfowl and hope to convince the United States Bureau of Biological Survey that this concession is due the sportsmen of this section of our country.

REPORTS.

VIOLATIONS OF FISH AND GAME LAWS.

July 1, 1920, to September 30, 1920.

Offense	Number of Arrests	Fines Imposed
Game.		
Hunting without license	23	$340 00
Hunting on posted grounds	5	95 00
Deer—closed season—killing or possession	23	805 00
Failure to produce deer horns or skin	11	425 00
Running deer with dogs—closed season	1	25 00
Female deer—spike bucks—fawns—killing or possession	51	2,725 00
Illegal deer hides	2	75 00
Brush rabbits—closed season—killing or possession	19	410 00
Tree squirrels—closed season—killing or possession	2	50 00
Quail—closed season—killing or possession	19	615 00
Doves—closed season—killing or possession	13	385 00
Ducks—closed season—killing or possession	27	925 00
Sage hens—closed season—killing or possesion	1	25 00
Nongame birds—killing or possession	5	110 00
Protected shore birds—killing or possession	4	200 00
Bear—closed season	6	105 00
Night hunting	1	25 00
Total game violations	213	$7,340 00
Fish.		
Angling without license	9	$230 00
Fishing for profit without license	42	430 00
Fishing in restricted waters	2	120 00
Illegal nets in restricted districts	29	600 00
Salmon—Saturday-Sunday fishing—excess daily limit closed season—taking or possession	2	200 00
Striped bass—underweight—excess daily limit and offering for sale closed season	28	505 00
Barracuda—undersized—taking or possession	1	25 00
Trout—excess limit—taking other than by hook and line	5	125 00
Clams—undersized—excess limit—taking or possession	8	250 00
Crabs—undersized—excess limit—taking or possession	7	95 00
Abalones—undersized—bringing to shore detached from shell	11	425 00
Dried shrimps—possession	5	165 00
Total fish violations	149	$3,170 00
Grand total fish and game violations	362	$10,510 00

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS,

July 1, 1920, to September 30, 1920.

Game.

Deer meat	1,230 lbs.
Doves	14
Quail	18
Ducks	71
Rabbits	23
Sage hens	2
Deer hides	2
Bear hides	1

Fish.

Striped bass	1,125 lbs.
Halibut	600 lbs.
Barracuda	885 lbs.
Salmon	55 lbs.
Perch	100 lbs.
Trout	12 lbs.
Crabs	377
Abalones	204
Pismo clams	117
Cockle clams	425 lbs.
Dried shrimps and meal	6,300 lbs.
Illegal nets	5

Searches.

Illegal fish and game	17

STATEMENT OF EXPENDITURES.

Period July 1, 1920, to October 31, 1920.

Administration:		
Commissioners	$130 18	
Executive officers	8,262 62	
Printing	716 20	
Research and publicity	1,605 58	
Accident and death claims	776 40	
		$11,490 98
Commercial fish culture and conservation:		
Superintendence	$4,836 25	
Inspection and patrol	10,078 33	
Research	11,009 75	
Statistics	3,376 73	
Market fishing license commissions	144 50	
Propagation and distribution of salmon	9,600 12	
		39,045 68
Sporting fish culture and conservation:		
Superintendence	$5,272 57	
Printing	99 05	
Prosecutions and allowances	117 50	
Angling license commissions	5,043 10	
Fish exhibits	4,287 94	
General patrol, pro rata share—		
San Francisco District (40 per cent)	12,883 72	
Los Angeles District (40 per cent)	5,670 59	
Sacramento District (40 per cent)	10,135 44	
Propagation and distribution of trout	71,079 29	
		$114,589 20
Game conservation:		
Printing	$124 26	
Prosecutions and allowances	536 44	
Hunting license commissions	9,630 50	
Mountain lion hunting (and bounties)	2,566 40	
General patrol, pro rata share—		
San Francisco District (60 per cent)	19,222 11	
Los Angeles District (60 per cent)	8,505 93	
Sacramento District (60 per cent)	15,201 59	
		$55,787 23
Tahoe camping ground		402 11
Total expenditures		$221,315 20

CALIFORNIA FRESH FISHERY PRODUCTS, JULY, AUGUST AND SEPTEMBER, 1920.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexican
Albacore										500	16,227,880	3,697	1,639,498	17,871,575	
Anchovies							78,345		185,767					264,112	
Barracuda	25						8,102	25,559	45,295	62,152	306,971	11,072	369,063	829,139	322,748
Bluefish								51						51	
Boccaccio		5					34,369	73,878	200,521					308,773	
Bonito								321	15	11,310	195,193	249	57,905	264,996	7,581
Carp				312	7,088	267								7,667	
Catfish				1,649	1,846	45								3,540	
Chilipepper							10,338	14,521	720					25,579	
Cultus cod	1,950	41,877	52				137,822	19,845	8,450					209,996	
Flounders		16					6,602	6,500	446	64	642			14,270	
Grayfish			20			759	3,690				5,267		139,225	148,901	
Hake							35,019	625	55					35,699	
Halibut	20,873	86,405	2,423				11,002	1,233	2,731	58,052	64,380	6,023	303,227	561,370	627,989
Hardhead					470									470	
Kingfish							365	5,111	2,607	551	11,025		285	19,944	
Mackerel								9,678	193,644	20,460	462,232	20,027	120,198	826,239	7,142
Mullet												226	1,211	1,437	90
Perch	178						11,254	103	132		3,327	1,869		16,863	
Pike				23	50	6								79	
Pompano							25	118			1,243	21	120	1,527	
Rock bass										1,689	46,814	6,213	32,460	87,176	485
Rockfish	6,472	651	49				285,060	80,200	85,435	9,690	30,059	1,330	125,316	624,274	2,630
Sablefish							72,912	314	21,931					95,157	
Salmon	948,280	2,388,179	3,711	1,200,972	282,895	1,075,496	1,413,002	31,223	26,149					7,380,919	
Sand dabs							76,358	77,250	2,571				470	156,649	
Sardines							29,925	2,833,620	26,233,995		9,278		754,802	29,861,620	
Sculpin											1,951	100		2,051	
Sea bass—black										145	7,671	392	8,726	16,934	6,288
Sea bass—white			16,291				5,560	98,521	5,778	71,838	630,705	5,516	72,178	906,387	158,156
Sea trout							382				554	20		956	
Shad				284	181	508								973	
Shad—buck						380								380	

Shad—roe				4										4	
Sheepshead										603		14	140	757	165
Skates							849	8,062				19		8,930	
Skipjack								93	3		4,218,843	2,514	2,401,095	6,622,548	4,245
Smelt	11,225		9,842				6,741	30,882	90,568	19,018	26,191	11,213	1,210	206,890	671
Sole	186	4					851,163	182,911	3,139	1,609	1,628	170		1,010,831	195
Splittail				23										23	
Striped bass			252	4,171	1,002	40,066	42,290							87,781	
Stingaree			14,000	103									59,121	73,224	
Swordfish											7,877		1,208	9,085	
Tomcod	111						2,909							3,020	
Trout—steelhead	5,900													5,900	
Tuna										410	1,181,572	1,232	3,210,419	4,393,633	200,415
Tuna—bluefin											10,519,862			10,519,862	
Tuna—yellowfin											446,073			446,073	
Turbot			34											34	
Whitefish											90			90	
Yellowtail										287	191,770	1,398	213,659	407,114	31,737
Miscellaneous	603			52	7		3,399	3,735	1,133	7,171	20,957	1,672	425	39,154	
Total fish	995,512	2,517,137	46,679	1,207,503	293,539	1,117,527	3,127,792	3,701,346	27,131,685	265,846	34,629,034	75,033	9,512,525	81,414,662	1,370,537
Crustaceans—															
Crabs, (doz.)	253						29	2	2					286	
Shrimps							309,759							309,759	
Spiny lobsters															22,443
Mollusks—															
Abalones									210,830	103,881				314,711	35,296
Clams—cockle			217									820		1,037	
Clams—mixed	2,898		3,202											6,100	
Clams—Pismo										91,494				91,494	
Clams—softshell		649	9,120			57,021	11,496							78,286	
Cuttlefish							6,225	1,627	1,747					9,599	
Limpets												7,800		7,800	
Mussels						988				70		9,400		10,458	
Oysters—															
Eastern (No.)			226,336				698,175							924,511	
Native			16,826											16,826	
Squid								26	31,161					31,187	
Miscellaneous—															
Turtles															36,339

All amounts shown in pounds unless otherwise specified.

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 7 SACRAMENTO, APRIL, 1921 Number 2

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A BRIEF HISTORY OF THE CALIFORNIA FISH AND GAME COMMISSION.

By HAROLD C. BRYANT.

INTRODUCTION.

The California Fish and Game Commission having completed fifty years of service to the state in the administration and conservation of wild life resources, it seems fitting that a review of the problems of the past and their solution, together with an outline of the distinctive accomplishments of one of the oldest state commissions, be published, to the end that the work of this Commission may be better understood and appreciated and that future activities may be governed by the successes or failures of the past.

Under the administration of Governor H. H. Haight, the legislature of 1870 established a Board of Fish Commissioners under "An act to provide for the restoration and preservation of fish in the waters of this state." The bill was approved on April 2, 1870, and Messrs. B. B. Redding, S. R. Throckmorton and J. D. Farwell were appointed as commissioners. The former commissioner served the state for more than ten years.

The United States Commission of Fish and Fisheries was not established until a year later. California thus had an organized fish commission nearly a year before the federal government took up similar work. The appropriation of $5,000 was largely used in importing new varieties of fish and in preserving those native fish which were recognized as valuable food fish. It was not until 1878 that the Commission was granted jurisdiction over game as well as fish.

"The first hatchery owned and operated by the state was situated on the grounds of the State University, in Berkeley. The California Acclimatization Society under the supervision of Mr. J. G. Woodbury had been experimenting, and had made several successful hatches of eggs introduced from the eastern states. Mr. Woodbury afterward became an assistant to Dr. Livingston Stone, at the Baird Hatchery, on the McCloud River, in 1872, when the first attempt was made to propagate the quinnat salmon in California.

INTRODUCTION OF FOOD AND GAME FISHES.

"The California Fish Commission during the first decade of its existence introduced into the waters of this state a number of varieties of food and game fishes and the attending results are regarded as being among the greatest achievements in fishculture and acclimatization."*

In the year 1872, an attempt was made to import from eastern states on a special aquarium car the following: black bass, glass-eyed perch, yellow perch, catfish, tautogs, brook trout, salt water eels, lobsters and oysters. Unfortunately, this large shipment never reached California owing to a train wreck which was described in the official report as follows:

"After leaving Omaha we stowed away as well as we could the immense amount of ice we had on the car, and having regulated the temperature of all the tanks, and aerated the water all round, we made our tea and were sitting down to dinner, when suddenly there came a terrible crash, and tanks, ice, and everything in the car seemed to strike us in every direction. We were, every one of us, at once wedged in by the heavy weights upon us, so that we could not move or stir. A moment after, the car began to fill rapidly with water, the heavy weights upon us began to loosen, and, in some unaccountable way, we were washed out into the river. Swimming around our car, we climbed up on one end of it, which was still out of water, and looked around to see where we were. We found our car detached from the train, both couplings having parted. The tender was out of sight, and the upper end of our car resting on it. The engine was three-fourths under water, and one man in the engine cab crushed to death. Two men were floating down the swift current in a drowning condition, and the balance of the train still stood on the track, with the forward car within a very few inches of the water's edge. The Westinghouse air-brake had saved the train. If we had been without it, the destruction would have been fearful.

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*Shebley, W. H.: History of the Introduction of Food and Game Fishes into the Waters of California. California Blue Book, 1911, pages 513–527.

"One look was sufficient to show that the contents of the aquarium car were a total loss. No care or labor had been spared in bringing the fish to this point, and now, almost on the verge of success, everything was lost." (Bienn. Rept. Fish Comm., 1872-1873.)

Undiscouraged by this loss the Commission asked Mr. Stone, who was in charge of the aquarium car, to return East and obtain a new shipment. With the help of the United States Bureau of Fisheries, 40,000 shad were secured in the Hudson River. These fish arrived safely and were planted in the Sacramento River at Tehama.

FIG. 28. Fisherman unloading catch of shad. Over a million and a half pounds of shad are taken annually in California. They were first introduced into the waters of the state by the State Fish Commission in 1871 and a second plant was made in 1873.

In the fall of 1872, a shipment of white fish eggs was secured in the East. These were hatched with success and 25,000 young white fish were planted in Clear Lake. During this period, Tahoe trout were introduced into several coastal lakes and streams. This constituted the first transplantation experiments.

On June 12, 1874, another importation which included black bass, glass-eyed perch, Schuylkill catfish, horn-pouts, silver eels, eastern salmon, rock bass, tautogs, lobsters and salt water eels, were distributed to different lakes and streams of the state. The tautogs were placed in San Francisco Bay and the white fish in Tulare Lake.

During the years 1876–1877 an attempt was made to acclimatize the awa, a fish from Hawaii. Apparently, there were no results from the plant made near Bridgeport, Solano County. Efforts to better establish the white fish, shad, and other fishes were continued and additional importations were made. The striped bass was introduced in 1879 and the carp in 1880.

The first published report on the edible fishes of the Pacific Coast appeared in 1881.

In 1898, six fish hatcheries were in operation, as well as several egg-collecting stations, and the Sisson Hatchery had been enlarged to handle 16,000,000 eggs at one time.

In 1903–1904 additional attempts were made to introduce the greyling and the land-locked salmon. Although fish were planted, no results were obtained. At the same time four dozen elegant quail imported from Mexico were liberated, but soon disappeared. Chinese quail were the subject of still another acclimatization failure.

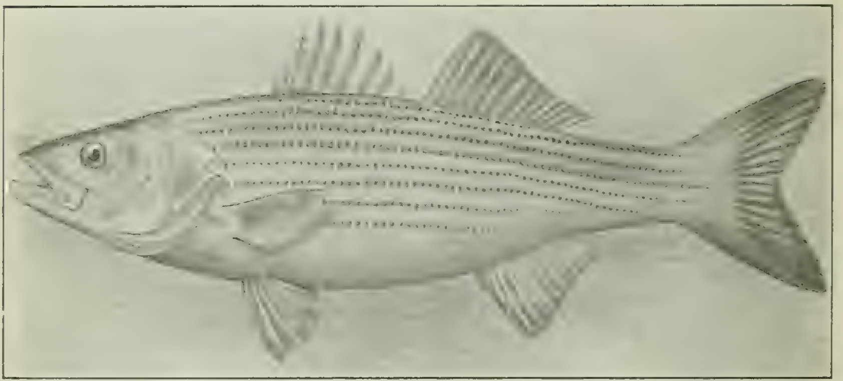

Fig. 29. Striped bass, *Roccus lineatus,* the successful introduction of which was accomplished in the year 1879, when 135 were planted near Martinez. A second plant was made in June, 1882, when about 300 were planted in Suisun Bay. The increase has been remarkable.

Continued interest in the introduction of new food fishes led to the importation and planting in 1908 of crappie, blue-gilled sunfish, yellow perch and ring perch, making about thirty different exotic species given a trial in the waters of the state. The above species have increased and are well established in the Sacramento and San Joaquin rivers. Attempted introduction of the ayu from Japan in 1920 met with failure.

Enthusiasm over the golden trout of the southern High Sierra led to many transplantations of this fish beginning in 1909 and 1910. As a result this species is now found 150 miles to the north of its original home in the head waters of the Kern River.

Transplantations of striped bass were also attempted in more recent years.

OUTSTANDING PROBLEMS AND ACHIEVEMENTS.

The first outstanding problem confronting the Commission was that of the pollution of coastal streams by sawdust from the mills. It was found that the fish life in those streams into which the refuse from mills was poured soon became barren and demand was made for legislation to prevent further pollution.

The need for fishways was apparent to the first board appointed and within a few years the building of them was made compulsory. The following quotation from the 1870–71 Biennial Report is of interest:

"At one dam on a tributary of the Truckee a mill owner consented to put in a fishway, at the earnest solicitation of one of the commissioners, and to prevent the expenses of a suit. He said the law was an infringement of his rights, and when the legislature passed an act to compel him to spend money in such foolish business they should have appointed a schoolmaster to teach the trout how to use the contrivance; he did not believe a fish could be coaxed to go near it. The next evening after the fishway was placed in position the fish were passing it every few minutes; the mill owner became a convert to the practical use of fishways. He soon tore away the cheap and temporary affair built to comply with the law under compulsion, and has erected in its place a substantial ladder that will last for years."

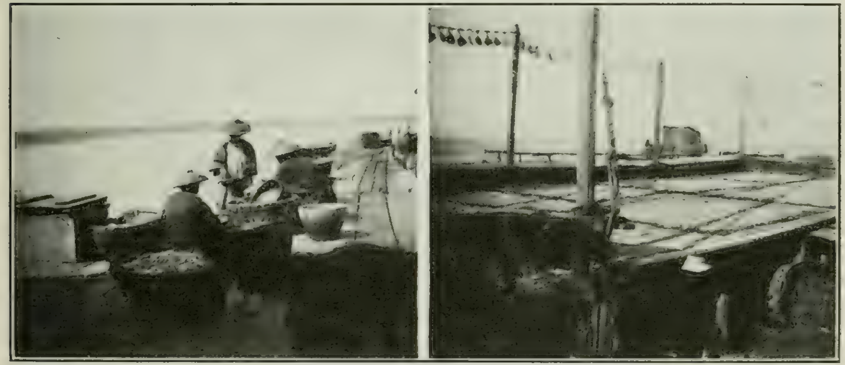

FIG. 30. Chinese shrimp fishermen and small fish, caught in the shrimp nets, being dried. The danger to young fish as a result of the shrimp fisheries early became an important problem of the Fish and Game Commission. Photographs by N. B. Scofield.

The most important problem confronting the Commission in the years 1876 and 1877 was the decreasing run of salmon in the Sacramento and San Joaquin rivers. A demand for a closed season to limit the catch was made as a result of investigation. Interest in the salmon situation continued for several years and statistics on canning operations and output were secured.

Decimation of immature fish as a result of the practices of the Chinese shrimp fishermen, and the destruction of the sturgeon by the use of Chinese set lines next attracted the attention of the Commission and in 1885 a strengthening of the patrol service was ordered as was also the building of a patrol launch. By this time shad had become so numerous that a repeal of the closed season was recommended. Interest in salmon centered around the complaint that sea lions destroyed large numbers as they entered the Bay, and the building of the first large state salmon hatchery which was located on Hat Creek.

An interesting political situation hindered the work of the Board during the years 1886 and 1888: "The work of the Commission was progressing very satisfactorily, until disturbed by the attempt on your part (the report was made to Hon. R. W. Waterman, then Governor of the State of California) to reorganize the Commission by placing thereon persons of your own selection. This attempted removal of the members of the Commission (Routier and Harvey) discredited the acts of the Commission, destroyed public confidence in the legality of their official acts, and defeated all efforts to an efficient discharge of their duties. That the legal status of the Board might be determined, Mr. J. D. Redding, who had been appointed by you to succeed Commissioner Routier, obtained the permission of the Attorney General to bring an action in the name of the people to oust Mr. Routier, but after suffering the action to remain in the courts for several months, he caused it to be dismissed. Subsequently, the State Board of Examiners, moved by the clamor of claimants who had furnished supplies, or rendered services to the state, agreed that the question as to who were entitled to act as the State Board of Fish Commissioners should be submitted to the Attorney General, and that the opinion of that officer should be binding upon the Board of Examiners until overruled by the courts."*

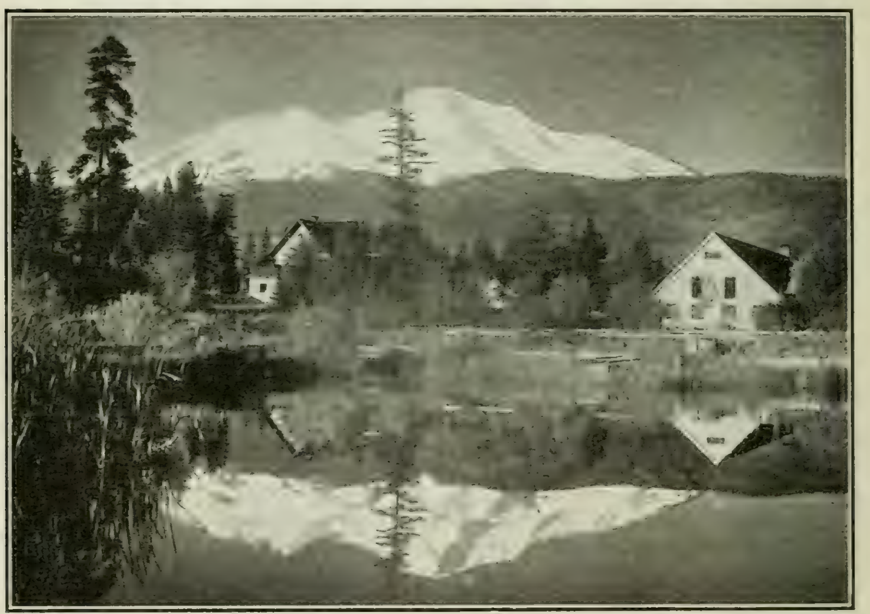

FIG. 31. A view of the Mount Shasta Hatchery taken about the year 1905. There are now six large hatchery buildings on the grounds.

The licensing of market fishermen as a means of controlling the salmon situation was begun on March 21, 1887.

Although appointed solely in the interest of preserving and increasing a fish supply, the Fish Commission early recognized the need for conserving game, notably deer, as is evidenced by the following excerpt:

"We recommend that the killing of deer be prohibited absolutely for the next two years, and also the having in possession of the skin of any deer for the same time. This is rendered necessary because of the great loss of these animals during the extremely severe weather of the last two winters, as well as their indiscriminate slaughter in some localities by hunters who defy the law with impunity. With these men, nothing save the heavy hand of the law can be made effective." (Biennial Report 1888–1890.)

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*Biennial Report of the State Board of Fish Commissioners of the State of California, for the years 1886–1888.

An appropriation of $2,000 first gave the impetus to the introduction of foreign game birds. In 1889 attempts were made to secure Oregon pheasants but actual stocking of the state did not begin until several years later.

The screening of irrigation ditches now attracted attention for the first time and steps were taken to improve the existing situation. It was at this time also that various conflicting county laws relative to the mesh of salmon nets made the enforcement of the salmon laws very difficult.

The sale of fish and game in San Francisco during the closed season became an important problem in the years 1891 and 1892. Under a system of cold storage it was possible for markets to hold fish and game, taken at a time when it was lawful, and to sell it during the closed season. It became apparent that unless some limitations were imposed the closed seasons for fish and game would cease to accomplish any purpose, and recommendations were made accordingly. Demand was also made for an investigation of the marine fishes and the spawning and hatching of the same.

By 1893, with an appropriation of about $20,000 and an income from fishermen's licenses of about $4,000, the Commission was able to employ an attorney, and twenty-seven deputies who served without pay. Furthermore, the first compilation of the game laws of the state was made and printed. Sportsmen's clubs which had by this time begun to appear were encouraged.

Of particular interest were the game statistics secured and published in the 1895–1896 Biennial Report. A table shows the receipts of game birds in the San Francisco and Los Angeles markets. The totals show 332,630 pounds of ducks, 175,444 pounds of geese and 37,880 pounds of California doves, pigeons and other game birds. The total valuation of the birds in the San Francisco and Los Angeles markets was $62,362.01.

In 1897, attention was again directed toward the introduction of ring-necked pheasants and 323 were purchased in Oregon and liberated in five-pair lots. Satisfactory increase was reported. A year or two later about 250 more pheasants were purchased in Hongkong for seventy-five cents each and liberated in several different places in the state.

Interest in commercial fisheries now developed to such a point that there was urgent demand for the abatement of the destruction to young fish by Chinese shrimp fishermen on which agitation had begun as early as 1885. This came as a result of investigations made by an expert which consumed several months' time. Statistics showing the amounts of the different varieties of fish sold in the San Francisco markets were prepared in order to show the need for protective legislation. The sturgeon, once of no market value, was found to be the highest priced fish on the market and with the supply insufficient to meet the demands, in spite of protective laws.

"As the hunting license law produced ample funds, and believing that the establishment of a State Game Farm where game birds could be raised in captivity and operated along the same lines as fish hatcheries, would be in entire accord with the spirit of the law, which authorizes expenditures for the propagation and restoration of game, and being encouraged by the example of other states, it was decided to undertake the establishment of one in California. Negotiations for services were entered into with several men who had had experience on game farms in eastern states, also with Mr. J. R. Argabrite, a resident of California, who was a successful raiser of pheasants in Ventura County. This resulted in engaging the services of Mr. Argabrite in September, 1908. He was immediately detailed to examine and report on a number of different locations that had been offered for the establishment of such an institution." (Bienn. Rpt. 1910.) A location was finally selected one mile south of Hayward, Alameda County, and a lease executed in November, 1908. A stock of pheasants was immediately secured together with four dozen Hungarian partridges. During the ten years of its existence the game farm reared and distributed several thousand pheasants, many quail and some wild turkeys. The expense of the farm seemed to be so out of proportion to the results obtained and the location so unfavorable for game propagation that the farm was finally abandoned in the fall of 1918. In the last years of its existence it was used more largely as an experiment station to determine the possibility of breeding different species of game birds and mammals.

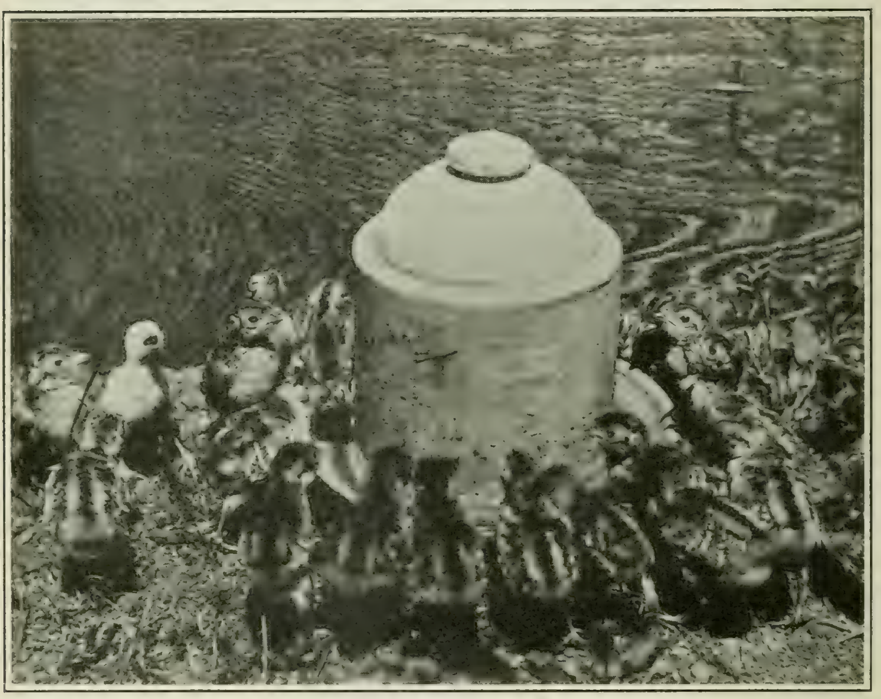

FIG. 32. Pheasant chicks at the State Game Farm. Many pheasants and quail were reared on the farm between 1908 and 1918. Photograph by H. C. Bryant.

When the game farm was first established there were a number of experiments made in the transplanting of native species. In 1908 and 1909, about three thousand quail were trapped and distributed in various sections of the state. About one thousand five hundred of this number were quail trapped in Lower California and liberated near Los Angeles. The incentive for these plants had its source in the mistaken idea that quail were decreasing because of inbreeding.

During the period 1910–1912, due to the concerted effort of Commissioner Newbert, public interest in fish and game conservation was aroused by directing and otherwise aiding in the formation of a representative protective organization, with a membership of over 16,000 sportsmen scattered through every county in the state. Each county sent representatives to Sacramento in order to aid in the formulation of the game laws so that the laws would be as fair to the people of the state as it was possible to make them. The organization, however, was short lived.

In 1912, Charles L. Gilmore was appointed by the Commission to make a stream survey, all of the available data to be recorded on maps together with fish distribution in proper position with reference to the locality of the actual plant. The best available sources of information and of statistical data were consulted and an intensive study made.

Beginning in 1913, the Fish and Game Commission started emphasizing scientific investigation of the many problems relating to fish and game. For these investigations experts from the State University and from Stanford University were secured. Professor Charles H. Gilbert undertook an inquiry into the life history of salmon and trout. Study of the life, abundance and conditions most favorable to the maintenance of our edible crabs was undertaken by Professor Frank W. Weymouth. A study of the clams of California was made by Harold Heath and one on abalones by Chas. L. Edwards. Complaint of the devastation caused by meadowlarks and other nongame birds led to the study of the relation of birds to agriculture by H. C. Bryant. At this time also, Miss Gretchen Libby was secured to conduct an educational campaign regarding wild life and wild life conservation in the schools of the state. Frank C. Clarke undertook an investigation of the deer problem and published a report.

On August 10, 1913, the employees of the Commission were included in the classified list of state employees under civil service. In this year also administrative divisions were established under the charge of branch offices at Sacramento, Los Angeles and Fresno.

Beginning in 1914, emphasis was placed on education and publicity, a separate department being inaugurated. Conservation work in the schools and in the summer resorts was undertaken, as well as the publication of a quarterly, CALIFORNIA FISH AND GAME, with the motto, "Conservation Through Education."

In 1917, in anticipation of an income from a newly established fisheries tax, scientific investigation of problems connected with the rapidly growing fisheries of the state were begun with the ultimate establishment of a State Fisheries Laboratory at San Pedro under the direction of Mr. W. F. Thompson. A patrol boat suitable for use in scientific work was built in 1918. A system of recording the catch of fish in order to furnish statistics of fluctuation and overfishing was also begun.

The game refuge as a means of game conservation came to the fore about 1909 but it was 1915 before extensive areas were set aside. In 1917, sixteen large areas were added making a total when the national parks and monuments are added of about 3,000,000 acres.

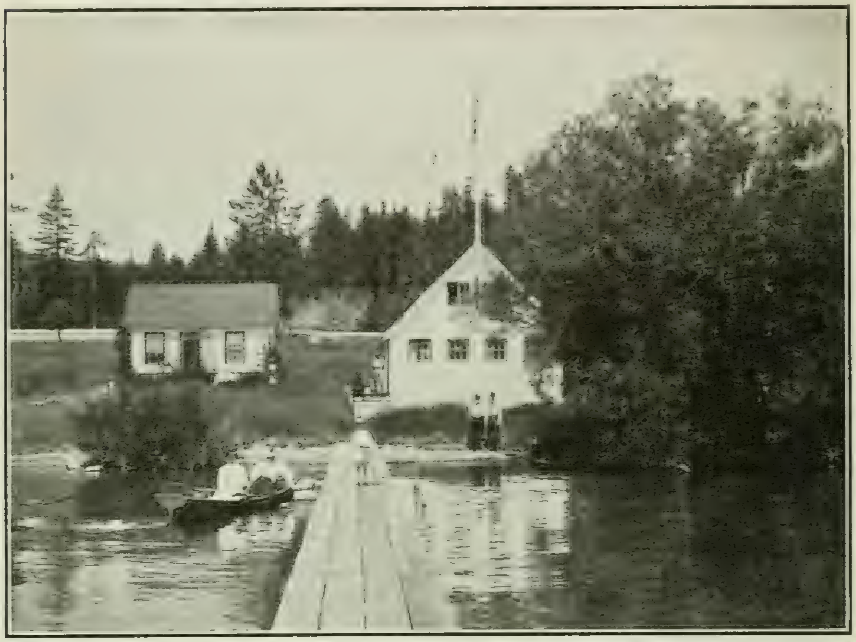

Fig. 33. The old Tahoe Hatchery as it appeared in 1906.

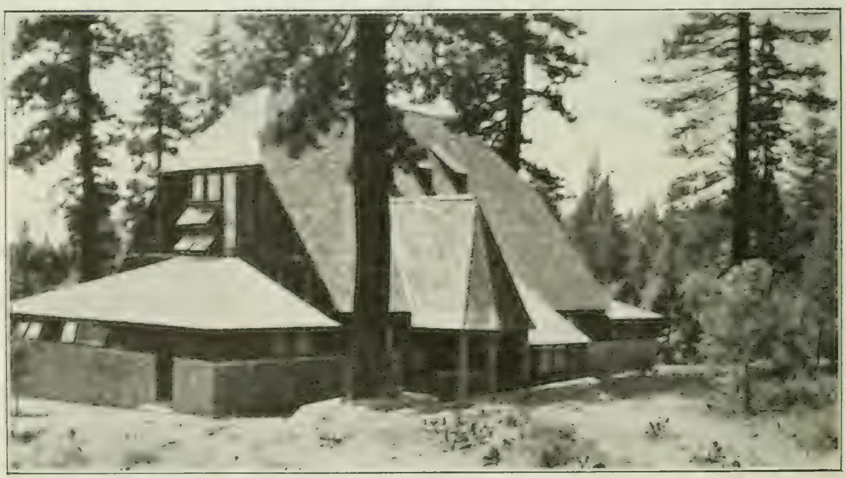

Fig. 34. The new Tahoe Hatchery completed August, 1920. Photograph by M. K. Spaulding.

In 1920, the Commission was operating sixteen fish hatcheries and six egg-collecting stations. The output in trout for the two-year period ending June 30, 1920, amounted to 34,000,000. In addition 29,000,000 Chinook salmon were hatched and distributed. Thus we find at the end of the fifty-year period that continued emphasis is being placed on fish propagation with attendant spectacular results.

PERSONNEL.

A succession of interested and discerning commissioners backed by a long list of faithful employees have combined to make a splendid working organization. The policy pursued by each newly appointed Commission of retaining employees instead of using political power to oust them has allowed certain policies to be continued through a term of years, without change and with correspondingly favorable results. The present head of the Fishculture Department, W. H. Shebley, and his assistant, E. W. Hunt, have served the Commisison continuously for thirty-five and thirty-two years respectively. The list of chief deputies and executive officers is very short considering the political changes during fifty years. The list on page 84 will furnish some idea of the men appointed by various Governors, as Fish and Game Commissioners.

Chief Deputies and Executive Officers.

John P. Babcock	December, 1892–October 15, 1901
Chas. A. Vogelsang	October 15, 1901–August 15, 1910
John P. Babcock	August 15, 1910–November 29, 1911
Ernest Schaeffle	November 29, 1911–September, 1916
Carl Westerfeld	December 8, 1916–April 28, 1920
Chas. A. Vogelsang	April 28, 1920—

CONSTRUCTIVE LEGISLATION AND COURT DECISIONS.

A number of court decisions have formed the ground work for the successful administration of fish and game laws, not only in California but in other states. The more outstanding cases have had to do with pollution, transportation and sale of fish and game. Brief statements regarding the more important ones follow:

It was in 1893 that the Supreme Court handed down a very important decision relative to the sale of venison. In the case of Simon Maier, the law making the possession of venison illegal during the closed season was upheld even though the deer might have been killed without the state.

Hide hunters were most active about 1880 when thousands of deer hides were shipped annually from Sacramento Valley towns, but a final cleanup of offenders did not come until 1893, when arrests were made in San Francisco and an important case won. Thereafter, violations of the deer law were less flagrant.

Several important game cases helped put a stop to illegal sale of game in the markets. A test case of the law fixing a limit on the number of quail, ducks, doves and other game birds that one person may possess during one calendar day was decided in favor of the people, and market men of San Francisco were forced to limit their supply to a single bag limit. Similar cases carried to the Supreme Court were decided favorably. Also the law prohibiting the sale of quail was upheld in the Supreme Court. Inspection of express shipments was begun in an effort to stop illicit shipping of game.

LIST OF FISH AND GAME COMMISSIONERS, 1870–1920.

Commissioner	Term of office	Home	Occupation	Recreation	Attainments in office
Hon. B. B. Redding	1870–1885	San Francisco	Lawyer	Angler	Introduction of fishes; striped bass.
Hon. S. R. Throckmorton	1870–1885	Sausalito	Capitalist	Naturalist	Introduction of fishes.
Hon. J. D. Farwell	1870–1885	San Francisco	Capitalist	Angler and sportsman	Introduction of fishes.
Hon. R. H. Buckingham	1885–1886	Broderick	Market fisherman; hotel man	Commercial fishing	Introduced carp.
Hon. A. B. Dibble	1885–1886	Grass Valley	Lawyer	All round sportsman	Restocking depleted streams.
Hon. T. J. Sherwood	1885–1886	Marysville	Newspaper man	Field sportsman	Developed interest in fish and game.
Hon. Joseph Routier	1886–1891	Routier	Fruit grower	Conservationist and field sportsman	Motto: "More fish"; conservation of game.
Hon. J. Downey Harvey	1886–1891	Los Angeles	Capitalist	All round sportsman	
Hon. Charles Josselyn	1886–1891	San Francisco	Ship chandler	Angler and sportsman	Propagation.
Hon. Joseph D. Redding	1891–Feb. 25, 1895	San Francisco	Lawyer	Angler and sportsman	Propagation.
Hon. Ramon E. Wilson	1891–Sept. 22, 1891	Napa	Lawyer	Angler and sportsman	Propagation.
Hon. Joseph Morizio	1891–Dec., 1892	Oakland	Commercial fisherman	All round sportsman	Commercial fisheries; propagation.
Hon. Hugh L. Macneil	Nov., 1892–Jan., 1895	Los Angeles	Capitalist; fruit grower		
Hon. William C. Murdock	Dec. 22, 1892–Sept., 1896	San Francisco	Capitalist	Sportsman and angler	Authority on fish and game.
Hon. H. F. Emeric	Feb. 8, 1895–Sept., 1897	San Francisco	Rancher	Angler	Originated the "Emeric spinner."
Hon. J. M. Morrison	Mar. 12, 1895–Jun, 1899	Sacramento	Restaurant man	Trap shooter	County game warden law; law enforcement; introduction of game.
Hon. Alex. T. Vogelsang	Nov., 1896–April, 1901	San Francisco	Lawyer	Angler	Propagation of salmon and trout.
Hon. C. B. Gould	Sept., 1897–April, 1901	Oakland	Business man	Angler and sportsman	Fish propagation.
Hon. Henry W. Keller	June 20, 1899–April 24, 1903	Santa Monica	Capitalist	Sportsman	Conservation; urged bag limits and non-sale of game.
Hon. W. W. Van Arsdale	April 5, 1901–May, 1907	Ridgewood	Rancher; lumberman	Sportsman	Conservation.
Hon. W. E. Gerber	April 5, 1901–May, 1907	Sacramento	Rancher; banker	Trap shooter; sportsman	Introduction of game.
Hon. John Bermingham, Jr.	Mar. 23, 1905–July, 1908	Pinole	Superintendent powder works	Bass angler	Fish propagation and fish patrol.
Hon. George Stone	May 14, 1907–May, 1910	San Francisco	Capitalist		
Hon. F. W. Van Sicklen	June 25, 1907–Nov. 3, 1910	Alameda	Business man	Angler and sportsman	Game propagation and game farm.
Hon. M. J. Connell	July 15, 1908	Los Angeles	Capitalist	Angler and sportsman	Golden trout propagation and distribution.
Hon. Lendal N. Gray	Nov. 3, 1910–Dec., 1910 Deceased	San Mateo	Shipping man	Angler and sportsman	
Hon. David Starr Jordan	Nov. 4, 1910–Aug. 4, 1911	Stanford University	College president	Ichthyologist	Conservation.
Hon. F. G. Sanborn	Jan. 21, 1911–Jan. 2, 1912	San Francisco	Business man	Angler	Fish and game propagation.
Hon. F. M. Newbert	Aug. 4, 1911	Sacramento	Merchant	Trap shooter; sportsman	Fish propagation; game protective association; untrammeled fishing rights.
Hon. Carl Westerfeld	Jan. 2, 1912–Dec. 8, 1916	San Francisco	Lawyer	Sportsman	Law enforcement; educational work.
Hon. E. L. Bosqui	Dec. 8, 1916	San Francisco	Printer	Angler	Commercial fisheries.

For several years the desire to curb the use of explosives in the capture of fish led to the offer of a reward of $25 for the arrest of any person killing fish by the use of powder or dynamite. For the two years ending September 1, 1898, nineteen cases where explosives had been used were prosecuted.

Owing to the efforts of the Commission a hunting license law was enacted in 1907, but the angler's license law was not enacted until 1913. The hunting license law met the approval of all those interested in the preservation of game and provided funds for a $20 bounty on mountain lions, after November, 1907.

In 1897, a case of importance which was brought before the courts was that against the Truckee Lumber Company for dumping sawdust in the Truckee River. The company maintained that the state had a right to protect fish only in navigable waters and that in all other waters the right is exclusively in the riparian proprietor. The Supreme Court ruled that the right to take fish extends to all waters and that therefore the title remains in the government. Also that the waters of the state furnish passageway for the fish and that they can not be subjected to private ownership. Further that the owner does not control all of the fish in the stream except as he reduces them to actual possession and that he can not kill or obstruct the free passage of those not taken.

Proper control of the transportation of game was attained by winning two important cases, one of which put the game transfer companies out of business and the other sustained the law prohibiting the use of parcel post in the shipment of game.

''For a number of years prior to 1913, there was an organized effort on the part of certain commission merchants in San Francisco to evade the limit law on ducks and to that end transfer companies were formed, which, while endeavoring to act as such, were, in fact, subterfuges of the several commission houses; for the reason that a transfer company is allowed to have in its possession more than the limit of ducks in one day, for the purpose of transportation only. When the Commission discovered this fact, all the ducks in the possession of the so-called transfer companies were seized. Thereafter, an action was brought in the Superior Court to restrain the Commission from seizing the ducks, so shipped, and for $5,000 damages. Judgment was rendered in favor of the Commission and against the plaintiff, for costs. Since the rendering of this decree, these so-called transfer companies have entirely gone out of business and it has reduced the unlawful distribution of ducks to less than one-half.'' (Bienn. Rept. 1914.)

The first legislation regarding the nonsale of game was brought before the people of California in 1893, when the market sale of deer was prohibited. In 1901, quail were taken from the market. But a crisis was reached when, in 1913, along with many other bills relating to fish and game, there was introduced into the legislature what has since been known as the ''Flint-Cary bill,'' prohibiting the sale of wild ducks and wild pigeons, in addition to the wild game the sale of which had been previously forbidden.

This bill was passed by both houses and signed by the Governor, but those who had failed to prevent its passage, namely, the Northern California Hotel Men's Association and others, got up a referendum petition, which led to the setting aside of the bill until the general election, November 3, 1914. The law failed of passage in the November election, but a few years afterwards the federal law was passed which prohibits the market sale of any migratory game which accomplished the desired result.

In July 1914, on account of the decision that the Districting Act of 1913 was faulty, it became necessary to revise the act and to change many of the laws on the statutes. This was done at the 1915 session of the legislature.

On September 11, 1917, Frank Phoedovius was arrested in San Mateo County for shipping deer meat by parcel post. He was tried and convicted and sentenced to pay a fine of $25 or be imprisoned in the county jail until said sentence was satisfied, in proportion to one day's imprisonment for every dollar of said fine. The fact that the postal laws prevented inspection of any packages shipped by parcel post had been taken advantage of by the market hunters and fishermen. The decision in this case took from them the last avenue through which the game and fish of the state could be unlawfully exploited.

CONCLUSION.

These features of the work of the Commission have been selected more or less at random and doubtless there are many other accomplishments which deserve recognition. Such have been left out for the sake of brevity.

The above achievements have of course been accompanied with many discouragements and some failures, but the latter are overshadowed by these notable successes.

With such achievements as a background the future should yield a rich harvest of new attainments.

PUBLICATIONS OF THE CALIFORNIA FISH AND GAME COMMISSION, 1870-1920.

Compiled by HAROLD C. BRYANT.

INTRODUCTION.

A test of the efficiency of any organization whose function it is to administer natural resources is to be found in the actual published results of scientific research. Certainly, a Fish and Game Commission is not functioning correctly if legislation and current activities are not based on the carefully ascertained facts secured as a result of scientific inquiry. That the California Fish and Game Commission has not been remiss in this regard is evidenced by the following list of publications. Although compiled largely as an aid to those making use of published articles on the fish and game of this state, the list should bring forcefully to the minds of all readers the outstanding features in the work and accomplishments of the Commission during the fifty years of its existence.

The list is as near complete as it was possible to make it. As the files of the Commission were destroyed in the San Francisco fire of 1906, reference has been made to the files of the State Library and the University of California Library, as well as to files of the Fishcultural Department.

All of the publications listed with but one or two exceptions have been published by the State Department of Printing at Sacramento.

In some instances new series of bulletins have been started under different administrations without due regard to previous series. These have accordingly been designated as new series, to avoid duplication of bulletin numbers, although this designation does not appear on the bulletins themselves.

The serial publications of the Commission have been: (1) biennial reports (a report to the Governor required by law); (2) California fish and game laws (a compilation of the laws relating to fish and game for the use of deputies); (3) abstracts of California fish and game laws (cards giving a summary of the open seasons, bag limits and other regulations); (4)fish bulletins (publications giving the results of scientific investigations); (5) game bulletins (publications giving the results of scientific investigations); (6) teachers' bulletins (a series designed for the use of teachers in the public schools); (7) miscellaneous bulletins (miscellaneous reports on the work and accomplishments of the Commission and publications appearing irregularly); (8) CALIFORNIA FISH AND GAME (a quarterly magazine with the motto "Conservation Through Education"); (9) reprints and separates.

BIENNIAL REPORTS.

Report of the Commissioners of Fisheries of the State of California for the years 1870 and 1871. 1872; 24 pp.

Report of the Commissioners of Fisheries of the State of California for the years 1872 and 1873. 1874; 28 pp.

Report of the Commissioners of Fisheries of the State of California for the years 1874 and 1875. 1875; 36 pp.

Report of the Commissioners of Fisheries of the State of California for the years 1876 and 1877. 1877; 30 pp.

Report of the Commissioners of Fisheries of the State of California for the years 1878 and 1879. 1879; 63 pp.
  a. Report upon the food fishes of San Francisco. By W. N. Lockington, pp. 17–58.

Report of the Commissioners of Fisheries of the State of California for the year 1880. 1880; 70 pp.
  a. Report on the edible fishes of the Pacific Coast, U. S. A. By W. N. Lockington, pp. 16–66.

Biennial Report of the Commissioners of Fisheries of the State of California for 1881–1882. 1882; 23 pp.

Biennial Report of the Commissioners of Fisheries of the State of California for the years 1883–1884. 1884; 33 pp.

Biennial Report of the Commissioners of Fisheries of the State of California for the years 1885–1886. 1886; 31 pp.

Biennial Report of the State Board of Fish Commissioners of the State of California for the years 1886–1888. 1888; 15 pp.

Biennial Report of the State Board of Fish Commissioners of the State of California for the years 1888–1890. 1890; 67 pp. 4 pls.
  a. Food fishes of the California fresh waters. By Carl H. Eigenmann, pp. 53–65.
  b. Why salmon are scarce. By H. W. Harkness, pp. 66–67.

Biennial Report of the State Board of Fish Commissioners of the State of California, 1891–1892. 1892; 65 pp., 3 pl.
  a. Salmon and trout of the Pacific Coast. By David Starr Jordan, pp. 44–58.
  b. Description of a new species of trout (Salmo kamloops). By David Starr Jordan, pp. 59–61, 1 pl.
  c. Description of the Golden trout of Kern River. By David Starr Jordan, pp. 62–65, 1 pl.

Thirteenth Biennial Report of the State Board of Fish Commissioners of the State of California. 1893–1894. 1894; 143 pp., 18 pl.
  a. Report of observations respecting the oyster resources and oyster fishery of the Pacific Coast of the United States. By Charles H. Townsend, pp. 92–108.
  b. Salmon and trout of the Pacific Coast. By David Starr Jordan, pp. 125–141, 7 pls.
  c. Descriptions of new varieties of trout. By David Starr Jordan, pp. 142–143, 3 pls.

Fourteenth Biennial Report of the State Board of Fish Commissioners of the State of California, for the years 1895–1896. 1896; 108 pp., 28 pl.

Fifteenth Biennial Report of the State Board of Fish Commissioners of the State of California, for the years 1897–1898. 1900; 75 pp., 3 pls., 3 figs.
  a. Report on the planting of quinnat salmon fry in the short coast streams of Marin County, California. By N. B. Scofield, pp. 49–62, 3 pls.
  b. Notes on the movements of the young of the steelhead trout in Marin County streams. By N. B. Scofield, pp. 63–65.
  c. Notes on an investigation of the movement and rate of growth of the quinnat salmon fry in the Sacramento River. By N. B. Scofield, pp. 66–71.

Sixteenth Biennial Report of the State Board of Fish Commissioners of the State of California, for the years 1899–1900. 1900; 45 pp.

Seventeenth Biennial Report of the State Board of Fish Commissioners of the State of California, for the years 1901–1902. 1902; 76 pp., 3 pls., 7 figs.
  a. The equity of the game laws. By a "convert," pp. 58–63.
  b. Studies in the natural history of the Sacramento salmon. By Cloudsley Rutter, pp. 64–76, 1 pl.

Eighteenth Biennial Report of the State Board of Fish Commissioners of the State of California, for the years 1903–1904. 1904; 112 pp., 16 figs.
  a. Pacific species of salmon and trout. By David Starr Jordan, pp. 75–97.
  b. The parent-stream theory of the return of salmon. By David Starr Jordan, pp. 98–102.
  c. Artificial propagation of salmon in the Sacramento River. By Cloudsley Rutter, with addenda by Commissioners, pp. 103–107, 1 fig.

Nineteenth Biennial Report of the State Board of Fish Commissioners of the State of California for the years 1904–1906. 1907; 112 pp., 3 colored pls., 29 figs.
  a. The trout and salmon of the Pacific Coast. By David Starr Jordan, pp. 77–92, 11 figs.
  b. Do quinnat salmon return to the native streams? By Cloudsley Rutter, pp. 93–97.
  c. The golden trout of the southern High Sierras. By Barton Warren Evermann, pp. 98–112, 1 pl.

Twentieth Biennial Report and Financial Statement of the State Board of Fish Commissioners for the years 1907–1908. (Not printed for distribution but appearing in the Appendix of the Twenty-first Biennial Report, pp. 75–79.)

*Twenty-first Biennial Report of the Board of Fish Commissioners of the State of California, for the years 1909–1910. 1910; 127 pp., 8 colored pls., 16 figs.
  a. Notes on the striped bass in California. By N. B. Scofield, pp. 104–109, 1 pl.
  b. Notes on spawning and hatching of striped bass eggs at Bouldin Island Hatchery. By N. B. Scofield and G. A. Coleman, pp. 109–117, 3 figs.
  c. Pheasant raising. By Chas. A. Vogelsang, pp. 118–124, 1 pl., 1 fig.
  d. Diseases of pheasants. By George B. Morse, M.D., V.S., pp. 124–127.

*Twenty-second Biennial Report of the Fish and Game Commission of the State of California, for the years 1910–1912. 1913; 80 pp., 5 figs.

*Twenty-third Biennial Report of the Fish and Game Commission of the State of California, for the years 1912–1914. 1914; 166 pp., 34 figs.
  a. Arid California and its animal life. By Frank Stevens, pp. 127–135, 2 figs.
  b. The California fish industry from a commercial point of view. By F. E. Booth, pp. 136–140, 1 fig.
  c. The National Forests in California. By W. C. Hodge, pp. 141–150, 3 figs.
  d. The American army of hunters. By Ernest Schaeffle, pp. 151–152.

NOTE.—Beginning with the Twenty-fourth, the Biennial Report consists of the report only, such papers as had been included heretofore being henceforth published as bulletins or in the quarterly CALIFORNIA FISH AND GAME.

*Twenty-fourth Biennial Report of the Fish and Game Commission of the State of California, for the years 1914–1916; 248 pp., 88 figs., 1 colored pl.

*Twenty-fifth Biennial Report of the Fish and Game Commission of the State of California, for the years 1916–1918; 98 pp., 11 figs.

*Twenty-sixth Biennial Report of the Fish and Game Commission of the State of California, for the years 1918–1920. 1921; 149 pp., 28 figs.

CALIFORNIA FISH AND GAME LAWS.

1885 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners; 1st ed., 77 pp.
1886 (No record available of 2d edition.)
1887 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners; 3d ed., 80 pp.
1889 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners; 4th ed., 86 pp.

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*Publications still available for distribution are marked with an asterisk.

1891 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners; 5th ed., 84 pp.

1893 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners, compiled by F. P. Deering, attorney for the Board; 6th ed., 142 pp.

1895 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners, compiled by Arthur G. Fletcher, clerk of the Board; 7th ed., 55 pp.

1897 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners, compiled by Arthur G. Fletcher, clerk of the Board; 8th ed., 55 pp.

1899 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners; 9th ed., 32 pp.

1901 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners; 10th ed., 48 pp.

1903 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners, compiled by Chas. A. Vogelsang; 11th ed., 48 pp.

1905 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners, compiled by Chas. A. Vogelsang; 12th ed., 52 pp.

1907 The Fish and Game laws of the State of California; published by authority of the State Board of Fish Commissioners, compiled by Chas. A. Vogelsang; 13th ed., 64 pp.

1909 The Fish and Game laws of the State of California; published by authority of the State Board of Fish and Game Commissioners, compiled by Chas. A. Vogelsang; 14th ed., 80 pp.

1911–12 State of California Fish and Game Laws; compiled and published by order of the State Board of Fish and Game Commissioners; 15th ed., 118 pp.

1913–14 State of California Fish and Game Laws; compiled and published by order of the State Board of Fish and Game Commissioners, arranged by Ernest Schaeffle, Assistant Commissioner; 16th ed., 123 pp.

1914–15 State of California Fish and Game Laws; published by the Board of Fish and Game Commissioners, arranged by Ernest Schaeffle, Assistant Commissioner; 17th ed., 130 pp.

1915–17 State of California Fish and Game Laws; published by the Board of Fish and Game Commissioners, arranged by John P. Fisher, game expert; 18th ed., 144 pp.

1915–17 State of California Fish and Game Laws; published by the Board of Fish and Game Commissioners, arranged by John P. Fisher, in charge license department; 19th ed., 144 pp.

1917–19 State of California Laws relating to Fish and Game; published by the Board of Fish and Game Commissioners, arranged by J. S. Hunter, assistant executive officer; 20th ed., 180 pp.

1919–21 *State of California Laws relating to Fish and Game; published by the Board of Fish and Game Commissioners, arranged by J. S. Hunter, assistant executive officer; 21st ed., 201 pp.

ABSTRACT OF FISH AND GAME LAWS.

Abstract of California Fish and Game Laws; first published in 1903 (?); biennially to 1920. (Two sizes, one for mailing, the other as a poster.)

Abstract of Laws pertaining to Commercial Fisheries.

1915–1917.
1917–1919.
1919–1921.

FISH BULLETINS.

1. Report on fish conditions; 1913; 48 pp., 3 figs. Contains:
    a. The abalone industry in California. By Charles Lincoln Edwards.
    b. The towing of salmon and steelhead fry from Sacramento to the sea in a "live car." By N. B. Scofield.
    c. The problem of the spiny lobster. By Bennet M. Allen.
    d. Investigation of the clams of California. By Harold Heath.

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*Publications still available for distribution are marked with an asterisk.

   e. Investigation of the life history of the edible crab (*Cancer magister*). By F. W. Weymouth.
   f. A general report on a quinnat salmon investigation carried on during the spring and summer of 1911. By N. B. Scofield.
   g. Trout and black bass planting and transplanting in the San Joaquin and Southern Sierra districts. By. A. D. Ferguson.

2. *The scientific investigation of marine fisheries as related to the work of the Fish and Game Commission in Southern California. By Will F. Thompson. 1919; 27 pp., 4 figs.
3. *The spawning of the grunion (*Leuresthes tenuis*). By Will F. Thompson, assisted by Julia Bell Thompson. July 15, 1919; 29 pp., 9 figs.
4. *The edible clams, mussels and scallops of California. By Frank W. Weymouth. January 10, 1921; 74 pp., 19 pls., 26 figs. (In press.)
5. *A key to the families of marine fishes of the west coast. By Edwin C. Starks. March 3, 1921; 16 pp., 4 figs. (In press.)

GAME BULLETINS.

1. *Report on game conditions; 1913; 67 pp., 8 figs. Contains:
   a. Investigation of the large game situation in California with special reference to deer. By Frank C. Clarke.
   b. Present and future status of the California valley quail. By Harold C. Bryant.
   c. Introduction of foreign game birds into the southern San Joaquin and tributary sections. By A. D. Ferguson.
   d. Educating the young people as to the need and value of wild life conservation. By Gretchen L. Libby.
   e. Investigation of the economic status of nongame birds. By H. C. Bryant.

TEACHERS' BULLETINS.

1. *A few reasons for teaching bird study in the schools. [By Gretchen L. Libby.] 1912; 4 pp.
2. *Birds as rodent destroyers. [By Gretchen L. Libby.] 1912; 4 pp.
3. *Owls. [By Gretchen L. Libby.] 1912; 4 pp.
4. Game conservation and its importance. [By Gretchen L. Libby.] 1913; 4 pp.
5. *Game conservation and its importance. [By Gretchen L. Libby] (continued from No. 4). 1913; 4 pp.
6. *Bats as desirable citizens. By Joseph Grinnell. 1916; 4 pp.
7. *The European house sparrow and its control in California. By Harold C. Bryant. 1916; 8 pp., 6 figs.

GENERAL.

MISCELLANEOUS BULLETINS.

SERIES A.

No. 1. Short report on classification of certain fish found in the Eel River, as steelhead trout, in salt water during month of September. By David Starr Jordan. October 12, 1891.

No. 2. Short report on classification of certain fish found in Webber Lake as *Salmo mykiss henshawi* (cut-throat). By David Starr Jordan. October 12, 1891.

No. 3. Short report on classification of certain fish found in Klamath River as steelhead trout, *Salmo gairdneri*. By David Starr Jordan. October 24, 1891.

No. 4. Salmon and trout of the Pacific Coast. By David Starr Jordan. February 15, 1892; 19 pp.

No. 5. Enforcement of game ordinance of city and county of San Francisco. March 15, 1892.

No. 6. Classification of the trout caught in Mount Whitney Creek. July 12, 1892.

SERIES B.

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Contains also: Diseases of pheasants. By Geo. B. Morse; pp. 9–12.

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Series C.

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No. 2. Bird study in the schools. By Gretchen L. Libby. 1912; 49 pp., 1 fig.

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Extra Series (not numbered).

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*Your Fish and Game—Swat the market hunter and give the boy a chance. 1913 (?); 14 pp. illus.
Statement from the Fish and Game Commission. 1913 (?); 4 pp., 1 map inclosed. (In reference to nonsale of game.)
*Conservation through education. 1915 (?); 14 pp., illustrations in color.

CALIFORNIA FISH AND GAME.

A publication devoted to the conservation of wild life and published quarterly by the California Fish and Game Commission.

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No. 1. January 15.
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No. 3. July 26.
No. 4. October 28.

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No. 3. *Notes on dry-fly fishing, No. 3. By R. L. M. July 26, 1920; 10 pp., 4 figs.
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Arid California and its animal life. By Frank Stephens; 9 pp., 2 figs. (From Biennial Report of 1914.)

The California fish industry from a commercial point of view. By F. E. Booth; 5 pp. (From Biennial Report of 1914.)

The national forests in California. By W. C. Hodge; 8 pp., 4 figs. (From Biennial Report of 1914.)

REPRINTS—GAME BULLETINS.

*Investigation of the economic status of nongame birds. By H. C. Bryant. 1912; 19 pp., 8 figs. (Reprint from Game Bull. No. 1.)

SEPARATES—CALIFORNIA FISH AND GAME LAWS.

*Act authorizing and regulating rearing and selling of domesticated fish. (Enacted 1911.) (Separate California Game Laws 1911–13, pp. 75–80.)

*Bowman Law (game farming). (Enacted 1913.) (Separate from California game laws 1913–1915, pp. 67–73.)

FINDING LIST OF SUBJECTS.

Abbreviations used:
B—Biennial Report.
F B—Fish Bulletin.
G B—Game Bulletin.
T B—Teachers' Bulletin.
M B—Miscellaneous Bulletin (A, B, C, D, E series).
R—Reprint, California Fish and Game.
R B—Reprint, Biennial Report.
R G B—Reprint, Game Bulletin.
L—Laws.
M—Maps.
C F and G—California Fish and Game.
S—Separate.

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NOTE—The last number of each year (October number) of CALIFORNIA FISH AND GAME contains a subject index of all material appearing in that magazine.

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MAPS.

Outline map of California. By Chas. L. Gilmore. 1914.

FINDING LIST OF AUTHORS.

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THE CONTROL OF THE MOUNTAIN LION IN CALIFORNIA.

By J. S. Hunter.

The one predatory animal for which practically no good can be said is the mountain lion. This animal without doubt kills more deer in California than are killed by all of the hunters. They also destroy a great many domestic animals. The actual meat value of the game and domestic animals destroyed by lions is impossible to estimate but it is safe to say that it runs into thousands of dollars.

During the many years that the Fish and Game Commission has been paying a bounty for every lion killed, hundreds have been taken, and up to January 1, 1920, $65,550 had been paid out in bounties.

In August, 1917, the amount paid for the killing of a female lion was increased from $20 to $30. Between that date and January, 1920, females to the number of 218 were sent in. Many requests have been made to the Commission that the bounty be still further increased. It is doubtful whether there would be any increase in the number killed even though the bounty were doubled. Most lions are killed either for the sport or on account of their destroying stock. The bounty is not the chief factor, but only an incident. In general as soon as a lion is reported there is a small army of hunters scouring the country, all anxious to boast of having killed a lion.

Contrary to the general opinion lions are not abundant in any part of the state. From the accompanying table it will be noted that Humboldt County leads with a total of 564 killed during twelve years time. The animal has been so reduced in that county that the kill has dropped from 113 in 1908 to 8 in 1919. In Shasta County, the next on the list, the kill has been less than one-half, 261 killed during the same period. Here, however, the animals have apparently not been reduced to the same extent as the kill in 1919 was approximately the same as in 1908.

In Trinity County 260 have been killed; last year only 14 as against 18 in 1908. In Siskiyou County none were killed last year; but in 1908 the number totaled 31 and in the twelve-year period 241. From this it would seem that lions in Siskiyou County are greatly reduced if not practically exterminated. Only one other county, Mendocino, reports more than 200 the first twelve years. In that county 219 have been killed; the number (22) taken in 1919 is just one-half those killed in 1908. Tehama County killed three during 1919, as against 31 in 1908, making a total of 159 in twelve years.

It is evident from the above figures that California lions are being slowly reduced in number and that the animals killed approximately if not entirely exceed the natural increase. If this is true we can form a very good idea as to the number of lions in the state. Forty-two per cent of the lions sent in for bounty are females. The female lion does not bring forth a litter every year but only every other year. Sometimes three kittens are born but the usual number is two. This would make the kill of 243 in 1919 the offspring of 243 females or 42 per cent of the total number of lions in the state. This calculation would give a lion population in California of about 575, which we believe is somewhere near the actual number.

This number of lions can do an enormous amount of damage to the deer. The minimum estimate of the number of deer killed by a single lion each year has been placed at fifty-two. Five hundred seventy-five lions will kill at least 30,000 deer during the year if deer are available and deer are common in every part of the state where lions are found.

The California Fish and Game Commission has determined to make every effort to still further reduce the number of lions. Knowing the increase of hunters and the ease with which hunters can reach what were formerly the most inaccessible places it will be necessary to stop the heavy natural drain on the deer supply caused by this animal. On this account an expert lion hunter has been employed. This man, Jay C. Bruce, is one of the best lion hunters in the country. In fact, the attention of the Commission was called to Mr. Bruce because of the many lions which he sent in for bounty from Mariposa County.

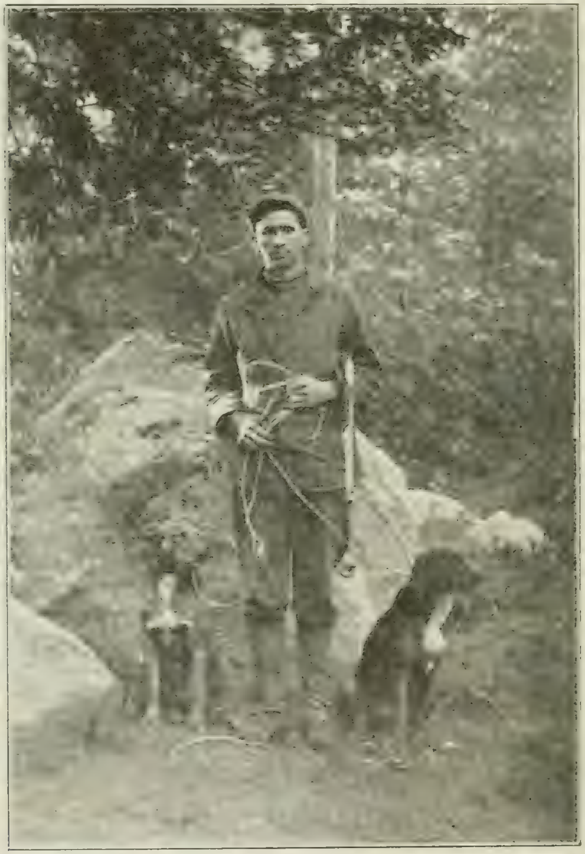

FIG. 35. Jay Bruce, state lion hunter, and his dogs. The Fish and Game Commission hires Mr. Bruce to cut down the number of mountain lions in the state game refuges.

Mr. Bruce was born in Mariposa County and spent a great deal of his time in the mountains becoming thoroughly familiar with the habits of the animals of the forest. On account of an injury to his left hand while working in a lumber mill he was forced to secure other employment and turned to that line of work for which his life long training had fitted him. On account of the bounty paid for the killing of lions he devoted considerable time to trailing them with dogs and was very successful.

His success as a lion hunter is due to the fact that he has made a study of the habits of the California lion and knows their habits thoroughly; also to the fact that he is an expert dog trainer and has his dogs trained so that they will follow only the tracks of either a bobcat or a lion and of no other animal. On account of this he can work without difficulty where deer are abundant. These dogs will never take the trail of a deer.

Since Mr. Bruce has been employed by the Commission he has worked chiefly in the game refuges and has made an excellent record. His greatest kill during any one month has been eight lions. Because of the success of the attempt to control the mountain lion it is the intention of the Commission to keep Mr. Bruce employed and later, perhaps, to employ other lion hunters.

Mountain Lion Bounties, 1907 to 1919—By Counties.

County	1907 to 1917	1918	1919	County	1907 to 1917	1918	1919
Humboldt	564	22	8	Santa Clara	19	3	2
Shasta	261	26	30	Colusa	17	3	---
Trinity	260	12	14	Calaveras	13	---	2
Siskiyou	241	1	---	Amador	9	---	---
Mendocino	219	18	22	Orange	9	2	1
Tehama	159	6	3	Plumas	9	---	---
Kern	134	10	15	Stanislaus	9	1	1
Lake	106	11	9	Inyo	7	---	1
Monterey	105	12	19	Lassen	7	---	1
Santa Barbara	99	6	19	Mono	7	---	---
Del Norte	97	2	5	Nevada	7	2	---
Tulare	95	11	17	Sierra	6	---	---
Mariposa	77	12	5	Modoc	4	1	---
San Luis Obispo	76	3	6	Yuba	4	---	1
Tuolumne	75	9	12	Napa	3	---	---
Los Angeles	49	8	9	San Joaquin	2	---	---
El Dorado	48	1	8	Santa Cruz	2	---	1
Glenn	43	3	3	Sutter	2	---	1
San Diego	41	4	5	Alameda	1	---	---
Ventura	40	2	2	Alpine	1	---	---
Madera	39	5	1	Imperial	1	---	---
Placer	37	2	3	Merced	1	---	---
Butte	33	---	2	Sacramento	1	---	1
San Benito	33	2	1	San Mateo	1	---	---
Riverside	29	4	5	Kings	1	---	---
San Bernardino	23	5	3				
Fresno	22	3	4	Totals	3,170	243	214
Sonoma	22	2	1	Grand total	------	------	3,627

HUNTING THE WILD BOAR IN CENTRAL FRANCE.

By W. L. Scofield.

We were at the dinner table when a Frenchman rushed in waving his arms and talking at the top of his voice a stream like a high pressure fire hose. Lunch was finished in an uproar. Finally I found there had been no murder but that a wild boar had been seen at the edge of town. Flambo, the reliable old hunting hound, was out calling on his friends so the gray haired patrone of the hotel stepped to the door and wound several blasts on a cow-horn. Flambo arrived on the lope and I supposed we were ready to start, but not so. We talked about it for another hour and had other glasses of wine all round. By this time other cow-horns were tooting and other mighty hunters arrived at the hotel with shotguns and game bags large enough to carry the tail of a good sized boar.

Finally eight of us were ready to start with seven shotguns, four game bags, one hound and five cow-horns. So we had another glass of wine, talked some more and started for the communal forest about a mile from town. We followed a trail through thick growth along a stream where boars might besport themselves on sunny afternoons, the dog on a string that choked him till his tongue hung out, high tension jabber from all the men and every few minutes some imbecile would let out a blast on his horn for the purpose of adding to the general hilarity and scaring all the game for miles around. Wooden shoes clattered and animated conversation continued till the dog took the trail and then the racket increased instead of subsiding.

We trailed the boar to a thicket and separated to surround him. Guns were unlimbered, conversation increased if possible, the dog was loosed so he could breathe again and chase the boar out of the thicket but we found the boar was not in the thicket. Instead of sitting down and waiting to be surrounded when he heard the uproar the fool boar had wandered off somewhere else so after a half hour's conversation about it we trailed him to the next thicket and repeated the same performance.

This continued all afternoon and furnished ammunition for the most exciting conversation but no boar. I came to realize that conversation was the chief object of the occasion. If we quietly surrounded the boar someone might kill him and then there would be no boar to hunt and talk about another day. My trouble was that I had gone out on a talking expedition without sufficient knowledge of the language so I took a walk alone to look over the country. Toward evening I had no difficulty in finding the hunters for I could hear the din for a couple of miles. We returned to the hotel having been without wine for more than three hours. Half the village gathered in the hotel kitchen to talk about the hunt. At odd times we had some supper and I retired at eleven o'clock with the talk still running at fever heat.

THE ABUNDANCE OF YOUNG PISMO CLAMS.*

By FRANK W. WEYMOUTH, Stanford University.

While collecting data for the study of the life history of the Pismo clam some interesting facts regarding the abundance and fluctuations in number of the young have come to light.

During the spring and summer of 1919 the young of the preceding summer (1918) were difficult to obtain. In the fall of 1919 the young of that summer were first observed and have been noted in almost incredible numbers up to the present time. During the present fall (1920) a special search for the young of the current year has been made but only a few specimens have been obtained, indicating an even poorer spawning year than that of 1918.

Before comparing in more detail the relative success of the three spawning seasons it may be well to give some idea of the habits of the young and the methods used in estimating their numbers. The young of the Pismo clam is found for the first three years chiefly between tides where it is easly studied. At low tide on the long Pismo-Oceano beach the firm wet sand which proves so good a road for automobiles is the zone of their greatest abundance and many can be turned up by digging down an inch or so with the fingers. A more striking idea of their numbers may sometimes be gained after an unusually low tide when this area has been left dry for some time. A tiny hole then often appears above the siphon or "neck" of each clam and at times due, apparently, to their movements a little mound is raised above each animal. A view of the beach at such a time is shown in Figure 36 and gives a vivid idea of the abundance of the young clams.

An actual count of the numbers of young clams has been made at intervals in the following way: A shallow trench the width of a clam fork (9½ inches) was dug across the entire wet beach and into the water at low tide (see Fig 37). All the clams found were sorted into age groups, as is easily done by differences of size in the young, and the number of each age counted. They were found chiefly in a narrow zone some 20 to 30 yards wide corresponding to the roughened areas shown in the photograph; above and below this scattering clams were found, but more than nine-tenths of the young were concentrated here. The actual counts made over a period of about a year and a half range from 1294 to 774.

The young spawned in 1919 are, in all collections since their appearance, the most numerous, forming never less than 98 per cent of the total. Those of the previous year (1918) form from 0.88 per cent to 1.32 per cent, while in the two last counts in which the young of the current year (1920) are represented they form only one-fourth of one per cent. Other years, when the young were as abundant as in 1919, are reported by the diggers but seem to come several seasons apart.

The total numbers of young occurring in the entire beach as the result of a successful season such as 1919 is amazing. The productive area of the Pismo-Oceano beach is some eight miles in length; of this the northern third is by far the most thickly populated. The count was not made at the northern end, but near the middle of the beach where the conditions more nearly represent a fair average. A conservative estimate of the total number might be gained by considering six miles of beach with the numbers found in the region examined. Taking an average of the more recent counts when 800 young of 1919 were present in a cross section of the beach 9½ inches wide, a mile would contain 5,150,000 and six miles 30,900,000 clams. Other earlier counts would bring the total to 45,000,000. To this must be added the beach at Morro which, though not examined for this purpose, probably would double the present estimate.

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*California State Fisheries Laboratory, contribution No. 23.

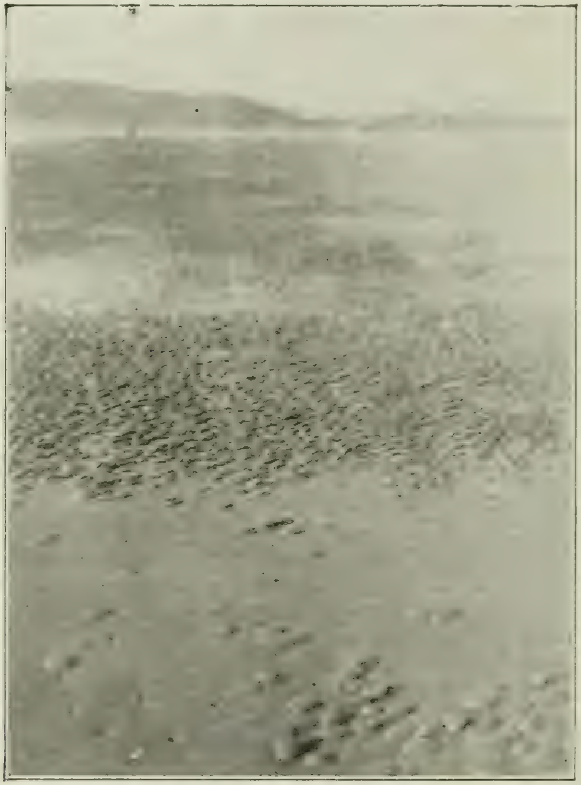

FIG. 36. View taken on Pismo beach at low tide. Note pits and raised areas mentioned in the text; every pit or mound indicates a clam and there are other clams that show neither. Photograph by F. W. Weymouth.

Several important lessons should be drawn from this. When conditions are favorable the young of the Pismo clam are produced and given a foothold in such enormous numbers that the supply of adults should be secure if the young have a fair show. But the "if" should not be forgotten. Large numbers die from natural causes over which we have no control. But there are losses which could be prevented. In order to protect the Pismo clam, laws setting a size limit of 4¾ inches and a bag limit of 36 have been enacted. Many tourists and summer visitors, however, thoughtlessly dig these young that are so easily found between tides and because they are so small take hundreds to furnish a single meal. The digging of an equal number of those of legal size would violate the bag limit but in realty would do less harm, as most of those which have reached a length of 4¾ inches have spawned, thus leaving behind them clams to fill their places. It is unfortunately true that other people including residents with undoubted knowledge of the law also take these young in large numbers. Unless these violations of a wise and necessary law are stopped by the cooperation of all interested people, their disastrous effects must soon be felt. All local residents that value the Pismo clam as a peculiar and distinctive local product should take every means possible to protect the young and to inform tourists and visitors of the need for its protection. With proper protection there is no reason why the Pismo clam should not remain a local asset—with continued destruction of young before they have spawned as well as the taking of the adults of legal size, it will only be a question of time when this fine clam will be practically exterminated.

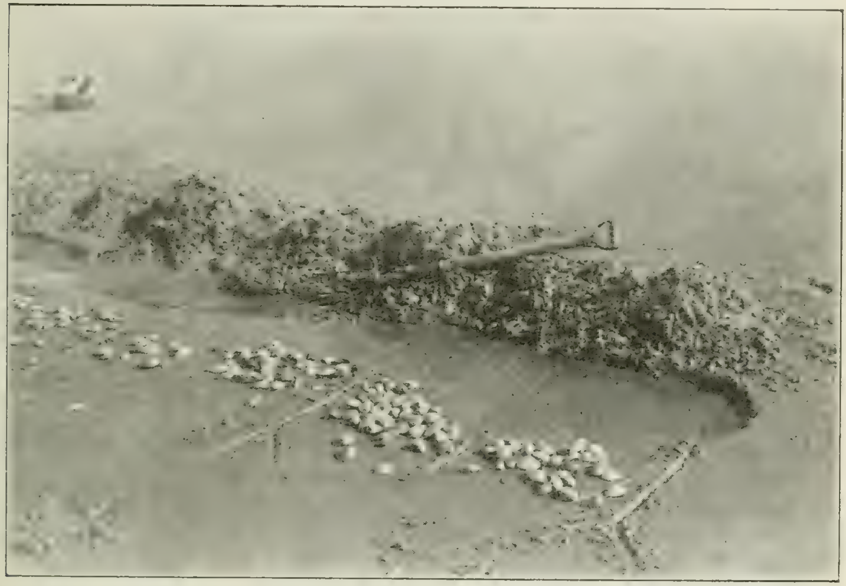

FIG. 37. Portion of trench made in counting young Pismo clams. All the clams shown came from a strip the width of the clam fork shown in the photograph (9½ inches). Photograph by F. W. Weymouth.

Another phase of the scientific work of the Fish and Game Commission is apparent here. The effect of an unusually good spawning year upon a fishery such as the sardine was discussed in the January issue.* Because of the ease with which the young of this clam may be studied we have here an even more striking example of such a successful spawning year in the season of 1919 which exceeds that of 1918 by seventy-five to one hundred times and that of 1920 by about four hundred times. According to reports the last season producing comparable numbers was four or five years ago. Evidently, for a number of years the clams spawned in 1919 will form the dominant class and when they reach legal size there will be an unusually good yield of clams. With a complete knowledge of the age reached and the rate of growth of the Pismo clam it would be possible to predict the future yield quite accurately from a yearly examination of the young such as here described.

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*See "The Future of the Sardine," by Will F. Thompson, CALIFORNIA FISH AND GAME, Vol. 7, pages 38–41.

Present indications are that the effect of this spawning year will be felt in 1925 and 1926, provided that proper protection is afforded the young in the meantime.

QUARTER-OILS OR HALF-POUND OVALS.*

By Will F. Thompson.

(California State Fisheries Laboratory, contribution No. 24.)

One of the great problems which presents itself to the student of fisheries, that of the effect of occasional successful spawning years, was considered in relation to the sardine, in the last issue of California Fish and Game. It was shown that the presence or absence of such great changes can be ascertained, and that such knowledge is most necessary to the proper understanding and prosperity of our greatest fishery. Moreover, the fascinating possibility that such a great change might be prophesied was held forth. In this article another problem, equally great and equally interesting is dealt with, and its close relationship to the great problems of biology is remarked upon.

Our sardine fishery, important as it is, has for the most part arisen within the last few years. At first an adjunct to that very recent one for the albacore, it has now reversed this relationship, and whereas once in Southern California the sardine was canned between albacore seasons, now the albacore and tuna are canned between sardine seasons. Such a limited experience has not until the present brought into question some of the fundamental facts upon which canning operations must rest. One of these is the subject of this paper; namely, the size of sardine which a cannery at Monterey, or a cannery at San Diego may expect to pack in the future. Will it can "quarter-oils," or "half-pound ovals"—the small fish or the large?

Experience thus far seems to indicate that the small fish will predominate to the south, the large fish to the north, that San Diego will be best for "quarter-oils" and Monterey for the larger sizes. This is an important fact—if fact it is—and if brief experience indicates the truth. Such a condition is highly probable, as any fisheries expert should know, for there are several fisheries in which such a distribution of sizes holds permanently. The cousin of the sardine—the Atlantic herring—has just such a distribution in the North Sea and along the Norwegian coast, and the Pacific herring may have the same along our own shores. The albacore of California has a similar difference in size between its southern and northern representatives. Yet we have had such a brief experience with the sardine of our waters that the seeming difference may be due merely to the passing at different times of dominating age classes such as we dealt with in the last article. Not until we know the real cause, or positive facts which will limit our conjectures, may we be reasonably sure of the truth. So little attention has been given to the basic laws of fishery science that what we have to say about the question is necessarily speculative—but will, we hope, demonstrate the possibilities and the fascination of its solution.

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*"Quarter-oils" are the sardines packed in small square cans in oil. "Half-pound" ovals are the larger size of fish packed in oval cans containing a half pound each.

Inevitably the theory most popular and most readily advanced to explain the differences in sizes is that of *migration*. According to this the sardines move towards the north as they grow older, and then the eggs are carried to the south by currents, so that there is a manner of eddy in existence. Perhaps some people would unhesitatingly assert that sardines hatch from the egg near San Diego and reach the State of Washington before they die. The more moderate minded would possibly confine themselves to a migration of the distance between San Diego and San Pedro. But it is worthy of note that either is a pure assumption, which must bear critical examination no matter what the degree of limitation imposed upon the theory.

It presupposes, indeed, that the sardine population is a homogeneous one, necessarily of the same race or breed from north to south. The proof of the existence of peculiarities in the fish from San Diego which are not present in the fish from San Pedro or Monterey, even though these peculiarities are not racial nor inheritable, would decidedly limit the theory of migration, if it did not eliminate it. The existence of such local "races" of herrings has been conclusively shown, to the great damage of the theory in the case, but it persists in modified form—that the herring of each local race migrate in the same way as all were supposed to do. And so it will doubtless be in the case of the sardine, the proof of the existence of local races will simply confine within smaller limits the ever-present theory. Nevertheless, it is of the greatest importance to distinguish local races of the sardine if possible.

But aside from this attempt to confine within logical bounds a theory tending to be adopted in a most unscientific way, there should also be examined certain fundamental facts which may bear on the question. Thus he supposed migration must vary enormously from year to year to account for the great schools which appear off Alaska, if indeed it could be shown that such schools could be drawn from the south without producing there a great temporary lack easily noticeable. And, again, it is an open question whether there is anything approaching the requisite permanent lack of adults in the south or the lack of young in the north. It may be totally unnecessary to postulate a migration, as a matter of fact, for sufficient adults or young may be present everywhere throughout the range of the species. Moreover, when one considers the vast numbers of eggs laid by fishes, like to the seeds of trees, and the few which must come to maturity from all that horde, it would seem perfectly obvious that even a slight difference in the surrounding conditions would cause great changes in the numbers which reach the various sizes, or stages of growth. And in this last possibility, we come to the second—perhaps more logical theory—that differences in proportion of adults and young may be due to the *differences in living conditions.*

For living conditions must play among fish much the same part that they do among the human kind. Scientists have shown that in barbaric races of man the prevalence of disease, hunger, and war tend to reduce the chances of survival and render the older inhabitants relatively fewer than in quieter communities. So we might expect among fishes, that if other animals preyed on the earlier ages, the proportion of adults would be much reduced. And it is perhaps a significant fact that the sardines farthest south live in waters which are populated with many active and predacious enemies, particularly of the mackerel type, such as the tuna and the albacore. The contrast between north and south is, indeed, obvious to anyone who has fished in both waters. What more natural, then, than the failure of the young fish in southern waters to survive in numbers to adulthood, despite those favorable conditions for hatching the eggs which these waters may afford?

And it is equally logical that in the far north the chances of survival after once hatching are much better. A great percentage may grow to maturity and increase very greatly the numbers of adult fish, and with them the average of the size. Naturalists have often commented on the fact that the species in colder waters although fewer in number each consist of vastly more individuals, than in warmer waters. Perhaps the difference in rate of mortality explains this—certainly it appears to harmonize with conditions in the sardine.

But if the colder northern waters with fewer enemies allow fish to survive after hatching, are the natural conditions as friendly to the floating egg? One might venture to surmise not, judging from what facts are known. For it has been in northern waters that the vast variation in the success of spawning seasons has been noticed. A favorable year may allow myriads of eggs to hatch, while five, ten or more years may elapse without a recurrence of such favorable conditions. So the phenomenon of a dominating year class arises, concerning which we wrote in the last article in California Fish and Game cited above. This phenomenon has been noticed only in northern waters in such species as the herring and the cod. It seems to occur in our northern sardine, as witness the appearance of the great schools in British Columbia during the last few years. So perhaps we may find that the abundance of large sardines in our northern waters depends, first on the only occasional success of a spawning season, and then on the growth of a large part of the resulting young to maturity. Such an hypothesis seems to fit the facts, and explain the sudden great extension to the north of a commercial abundance of sardines.

If, however, we go far enough to the south, say to Monterey, we may find a region where there is both a reasonable chance of spawning successfully, and a comparatively low rate of mortality still. Then—like nations under similar conditions—the average age of the population would be high, and the young somewhat scarce among the many adults. But even there we might find in a modified degree the phenomenon of dominating age classes, making the sardine appear to be smaller or larger in average size at times. So some such conditions may yet be found at Monterey.

Thus this second theory must be borne in mind, that conditions of existence may lead to varying kinds of populations. To the south, as at San Diego, the numerous young fish may find it hard to survive to maturity, to the extreme north the eggs may not develop save under favorable conditions recurring but seldom, and midway the adults may be more abundant because the young are able to survive the less numerous enemies. The hypothesis certainly harmonizes with the facts as we imperfectly know them. Yet other theories may fit these facts nearly as well.

For if surrounding conditions can modify the actual numbers of fish of various sizes, it is equally probable that they can modify their appearance in the commercial catch. There is no greater fallacy extant, it seems to us, than the assumption that the fishermen catch a fair, or even a passably fair, representation of what actually exists in the ocean. It remains to be proved in every case that a fisherman with his gear, or—what is far more dubious—a scientist with his apparatus, can take a fair sample of any species or of any group of species. So for the third theory we may have one that is perhaps somewhat comforting to the commercially interested man: namely, that the *difference in sizes is really an illusion.*

It is common knowledge that in the method of fishing many things vary from day to day. To some fisheries more or less smooth water is necessary for successful operations. Or market conditions may change and shift the demand from one class of fish to another. Or on one part of the coast fish are taken by one method and on another a different one is used, perhaps merely because of the nationality of the fishermen. So, great caution is necessary that careful investigation of the fisherman and his methods is made at the same time that the fish is studied.

These things are comparatively easily discounted, but there is another category of circumstances not as readily investigated, namely, the effect of physical conditions, such as temperature or currents, upon the accessibility of the fish. There may be, for instance, many adult sardines at San Diego, but oceanic conditions may be such that they are simply never seen, never appear to the fishermen. And the great run of large fish in the far north may not be due to the unusual abundance of some year's spawning, but simply to the prevalence of unusual conditions which may serve to bring the fish in. Or an adult fish may react differently to temperature conditions, as is true of the albacore in a certain degree, and the change in temperature, however slight, may have a decisive effect in preventing the appearance of the large fish or of any particular class, save under the most favorable conditions. Or perhaps the varying salinity of the superficial layers of water may have a decisive influence, as is supposed to be the case in some parts of the North Sea. So there are many things which might be surmised to have an effect on the abundance of fish, so many and in truth so obvious, that fishermen are very prone to adopt this theory. Yet it is very easy to underestimate the ability of the fisherman to take the fish, and very easy to overestimate the sensitiveness of the fish to such changes as occur. Careful observation should be able to decide as to the probability of such occurrences as are mentioned in this paragraph, and to test the real presence or absence of the fish.

To the average casual reader these theories must be confusing, and decision between them very difficult. But there is, indeed, every logical reason to believe that the phenomena which must result from any of these possibilities would vary in a manner clearly distinguishing them according to their origin. Thus the appearance of the large fish far to the north may be due to the dominance of one year class resulting from one spawning, or it may be due to favorable conditions bringing in the schools toward shore. But nothing should be easier to the scientist with a knowledge of methods of reading age from the scales than to decide whether the fish that come in are really made up of one great year class. That is simply an illustration of one of the possible methods of scientific attack, resultant from close observation and knowledge. So many are they that we may reasonably hope to solve most of the tangled problems that lie before us.

These are problems which are not merely of importance commercially but bear intimately on some of the greater problems of biological science. The true distribution of a species, for instance, may be seen to be in question, and the inadequacy of delimiting such distributions from collections of isolated individuals should be plain. We are in truth studying the factors which limit the distribution of a species, a subject still unknown, despite its importance to the student of the origin of species, or the nature of species. There seems to be no more favorable method of approaching these great problems of biology than through the study of the vast mass of data which the commercial fisheries place at our disposal. They are problems which involve a knowledge of great numbers of individuals and of the actual effect which conditions have on those numbers. The study is statistical if you please, is of commercial value, too; but still is scientific, and biological.

WHALES AND SARDINES.

By Will F. Thompson.

It has recently been the writer's fate to meet several times the argument advanced in all seriousness that the killing off of the whales and the albacore leave a surplus of sardines which might as well be used as fertilizer. This argument for the presence of a surplus is untenable, as is well known by fisheries scientists. Many arguments more valid may be cited leading to an opposite conclusion.

In the first place such animals as the whale, the albacore or tuna perhaps consume more enemies of the sardine than they do of the sardine itself. These fish, such as the anchovies, the mackerels, red cod, etc., probably feed on the young, as well as on the adult sardine. The anchovy, for instance, has a beautiful straining apparatus in its gills with which it might remove the eggs and larvæ from the water to swallow them. And the sardine eggs and young float freely in the open sea for such fish to take. These small things are so delicate that they must be destroyed immediately and no method of ascertaining the amount consumed is at hand. It is, on the other hand, easy to satisfy one's self about the sardines such fish as mackerel consume. So the existence of the whale and albacore may be actually a benefit to the sardine fishery, and their destruction a disaster to the industry.

A classic case could be found in Alaska, where the numbers of herring should supposedly be increased by the practical extinction of the halibut, which consumes the herring in quantities. But careful investigation of the halibut food showed conclusively that it ate more enemies of the herring than it did of the herring. It ate gray cod, long-jaw flounders, dog-fish, rat fish, red cod and black cod, each as often as it did herring—and every one of those species is a bitter enemy of the herring.

Similar cases of mistaken conclusions as to the harmfulness of birds may be found. For many birds eat injurious insects to an extent that far overbalances any harm the birds themselves do to crops. The same is perhaps true of the whale and the albacore.

In so far as the albacore is concerned, an endeavor on the part of the writer to investigate its food met with disaster. For it was soon found that the fishermen were using sardines, anchovies and other fish for bait, or to chum the fish, and that the albacore which were caught had naturally a great many such bait fish in their stomachs. The same applies to the salmon. But, indeed, even ignoring this fact, it was found that such things as squids, small crustacea, and fish of other species formed a large part, at times all of the food of the albacore, tunas and salmons.

Another argument just as valid as that in support of the theory of the surplus of sardines is available. For it is common knowledge that the whale eats even more anchovies than it does sardines, and the anchovies may make serious inroads on the food supply of the sardine, being nearly the same type of feeder. Therefore the destruction of the anchovies must be advantageous, and the whale a benefactor, indeed.

The point to what has been said, we would emphasize, is the positive fact that nature is exceedingly complex, and that those who come to ready and easy conclusions are inevitably wrong. We do not wish to assert in an unqualified way that we are correct in saying that the destruction of any such animals as the whale, the albacore, the tuna and such animals is a disaster to the sardine, but we do wish to assert that the balance is just as likely to go that way as the other, and probably does. And that would be the case were all the suppositions advanced above untrue.

And as a matter of fact, if such great numbers of albacore, of of tuna and of whales have been taken, it may be high time to propose some protection for them.

The argument that there is now a surplus of sardines is a strange one to meet at this time. If we had three vessels at sea in a storm and two of them were sunk, would we talk confidently about the safety of the other? Yet that is just what is happening. The great salmon fisheries of the Alaskan and British Columbian coasts are on the verge of extinction, as everyone now knows, despite the fact that years ago statements that the supply was inexhaustible were quoted just as freely as they are now about the sardine. And the same is true of the halibut fisheries to a still greater extent. As in those two fisheries, once the two greatest on our coast, disaster has come, so may we well watch vigilantly lest disaster come to another great fishery, that for the sardine. Abstract speculation on intricate things such as the effect of killing off the enemies of the sardine is worse than useless in the face of real experience.

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All material for publication should be sent to **H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.**

MAY 6, 1921.

PEOPLE AND THE LAW.

People obey the laws because they believe them wise and just—not merely because the laws happen to be.

That fish, or that game law serves best its purpose which is based on real conditions, exact needs and which operates without undue injury to any person or class.—Adapted from *Pascal.*

THE 1918–1920 BIENNIAL REPORT.

The usual biennial review of the work of the Fish and Game Commission has appeared in a striking green cover with a colored reproduction of the Loch Leven trout. The report, which contains 150 pages, deals with the work of the various departments and is abundantly illustrated with photographs showing the work and accomplishments of the Commission. A comparison of this volume with the first report issued in 1870 furnishes an interesting contrast and proves that during fifty years of service to the state there has been great improvement in organization and in results.

In the introductory pages a tribute is paid to the men who so creditably served their country during the world war and a page is devoted to six employees who have died during the past two years.

Outstanding features of the biennial period have been the rearing and planting of 34,000,000 trout fry, the greatest number ever planted by the Commission in its history in a like period. In addition approximately 29,000,000 Chinook salmon were distributed in the Sacramento, Klamath and Eel rivers. The new Tahoe Hatchery with four times the capacity of the old one is described and figured.

The number of arrests and amount of fines assessed on offenders during the biennial period is the greatest in the history of the Commission—1,891 arrests and $49,426 in fines.

The Commercial Fisheries Department reports wonderful progress in connection with the gathering of fisheries statistics and the solving of many problems relating to the fisheries. Several graphs vividly show the growth of the different fishing industries and the output of the canneries.

Among the legislative recommendations in the report are a shortened trout season and a one buck limit on deer.

The educational and publicity campaign beginning in 1914 has been successfully continued. Particularly noticeable results have been obtained in the schools and in the summer resorts of the state.

NEW FISH BULLETINS.

There are now ready for distribution two new fish bulletins. Bulletin No. 4 is entitled, "The edible clams, mussels and scallops of California," and is the result of research made by Professor F. W. Weymouth, of Stanford University. The bulletin contains seventy-five pages, nineteen plates and twenty-six figures. The author notes that there were two purposes in issuing it. "First, it is an attempt to estimate the economic importance to the state of the bivalves here treated by putting on record the extent and position of the available mollusk producing grounds, the number and abundance of the edible species, and, by contributing to a knowledge of their life histories, lay the foundation for such protective legislation as may in the future be found necessary. Secondly, it proposes to make available to the camper and amateur naturalist a means of identifying the more common and important bivalves." Perhaps the most attractive feature of the bulletin is a key well illustrated which should be usable by the amateur in identifying any of the species of mollusks found in the state.

Fish Bulletin No. 5 is entitled, "A key to the families of marine fishes of the West Coast," and appears under the authorship of Professor E. C. Starks, of Stanford University. The key has been tested out by the students of Stanford University and should be of value to any one in the identification of fish which fall into their hands.

FISHCULTURAL METHODS UPHELD.

A recent newspaper attack on the methods and accomplishments of the fishcultural department has brought forth many protests. Resolutions and letters in large quantity have been received from sportsmen's clubs, chambers of commerce, forest supervisors, boards of supervisors, and private individuals pointing out the successes attained in planting trout. Among the sportsmen's clubs defending the present methods are the Sierra Rod and Gun Club, the Grass Valley Sportsmen's Club, Lindsay Fish and Game Protective Association, El Dorado County Rod and Gun Club, Caspar Rod and Gun Club, Fresno Sportsmen's Club, Yuba County Fish and Game Association, and the Alturas Sportsmen's Club.

All unite in pointing out that in order to keep up the supply of trout where there is heavy fishing, it is essential to stock the streams annually. Many point out that had not annual plants been made the streams would now be barren of fish life. Fortunately, the opposite condition exists, owing to fishcultural operations.

Mr. C. J. Walters, of Independence, states that streams that are extensively fished have increased wonderfully since the planting of fry began. According to Robert E. Eddy, Secretary of the Lindsay Fish and Game Protective Association, it is the unanimous testimony of our members who know the streams and of ranchers in the mountains, "that fish are now being taken from places formerly barren, since planting began regularly in this section." George A. Green, President of the El Dorado Rod and Gun Club, writes: "Prior to 1910 no eastern brook trout had ever been taken from the American River, the fish life being entirely limited to the rainbow trout. In 1910, our club received from the Fish and Game Commission some eastern brook trout fry. These were planted in the American River near Kyburz. We have received and planted some eastern brook fry every season since. Today fifty per cent of the trout taken from the American River between Riverton and Phillips Station are eastern brook trout. The same holds good in regard to all other streams in our country."

All of the communications report satisfactory results and state that the fry are received in uniformly good condition. The one complaint evidenced is that individuals and organizations are unable to secure as many fish as they desire for planting purposes.

IN MEMORIAM—FRANK SHOOK.

It is to be regretted that deputy Frank Shook, one of the oldest and most loyal deputies in the employ of the Commission, died on January 16, 1921, at his home in Salinas.

From the time of his appointment as deputy, on November 15, 1907, Frank Shook was one of the most sincere workers of this Commission. He was always on duty and always gave the best service possible. He not only knew the violator and his ways, but he knew thoroughly Monterey County, the country which he patrolled, and it is because of the fact that he possessed all of the many qualities that are so necessary in one entrusted with the enforcement of the law that he was so valued and trusted as an employee of the Commission. That his loyal service was appreciated by the Fish and Game Commission goes without saying.—J. S. H.

THE NATIONAL GAME CONFERENCE.

The annual National Game Conference under the auspices of the American Game Protective Association was held in New York City on January 24 and 25. For the first time, the California Fish and Game Commission was represented at this conference. Dr. H. C. Bryant was able to attend, owing to a lecture program regarding nature guide work which was made possible by Mr. Stephen T. Mather, Director of the National Parks. Dr. Bryant gave an illustrated lecture on the subject, "Education as part of the conservation program," in which the work of the California Fish and Game Commission was outlined; emphasis being placed on the work in the schools and in the summer resorts. At the banquet, the last night of the conference, motion pictures showing wildfowl on Lake Merritt, California's first game refuge, were shown and received very favorable comment.

Outstanding features of the program were the discussions on a federal license, to take the form of a stamp which can be pasted on the state license, and on the need for a treaty with neighboring countries relative to migratory fishes to supplement the one relative to birds, which is already in existence.

Considerable interest was also displayed in the report of the Virginia Fish and Game Commissioner regarding a law to control the vagrant dog. The law which is administered by the Fish and Game Commission has been effective in the destruction of 30,000 vagrant dogs since its enactment. That any state should have a dog problem, as well as a cat problem, was a surprise to those attending the conference.

A large number of resolutions relative to the conservation of game were passed.

THE STEELHEAD, A DISTINCT SPECIES.

The exact status of the steelhead trout has long been a mooted question. Although for many years considered specifically distinct, it has in more recent years been considered a sea run form of the rainbow. The United States Bureau of Fisheries now announces (Bureau of Fisheries Document No. 896, pp. 6-7) that Dr. W. C. Kendall, scientific assistant and ichthyologist, is bringing to completion a report which it is believed will settle the much discussed question of the specific identity or distinctness of the rainbow and steelhead trouts.

"After a careful study of the fish from taxonomical, anatomical, and distributional evidence the conclusion is reached that there are at least two wild forms which have been confused under the names of rainbow and steelhead trouts. One is predominantly migratory (ascending fresh waters from the sea), the other predominantly a permanent fresh water inhabitant. The name *Salmo irideus* was originally bestowed upon a small steelhead form, as was also *Salmo rivularis*. There is absolutely no doubt concerning the proper application of *Salmo gairdnerii* to the steelhead, as Richardson's description is that of a large Columbia River fish and not a small blueback salmon (*Oncorhynchus nerka*), as one writer has stated. Contrary to current descriptions, the steelhead has larger (fewer) scales than the rainbow, and there appear to be other though inconspicuous and concealed structural differences.

There is probably more than one species or race of rainbow trout, and possibly also of steelhead. However, the rainbow trout of fish culture is largely from McCloud River (California) stock and should bear the name, not *Salmo irideus*, but *Salmo shasta*. The fishcultural rainbow stock has been more or less affected by admixture of another form principally from Klamath River, which may be another form or species of rainbow or perhaps a steelhead. This admixture is clearly perceived in the appearance and structure of many specimens of the rainbow stock of some of the hatcheries. The steelhead stock has always, so far as known, been unadulterated *Salmo gairdnerii*, although in the distribution from hatcheries it is known that in some instances the two forms have been regarded as identical and distributed as rainbow trout. Pure *Salmo shasta* is distinguished from pure *Salmo gairdnerii* by the smaller scales of the former."

SALMON DESTROYED ON SPAWNING BEDS.

Because of the law which allows of the taking of three salmon by means of a spear, in districts one and two, between September 25 and November 15, many salmon are being destroyed on the spawning beds in Shasta and Siskiyou counties. Aliens, as in other cases, are the greatest violators. They often build a sort of trap across a stream and working at night spear the fish as they move through a narrow entrance to the trap. As many of the fish are unfit for food, because on the spawning grounds, these violators sometimes kill as many as from fifteen to twenty fish and save but the three that they are allowed by law. The deputies of the Commission have difficulty in apprehending these violators because they work at night and because they are not to be found with more than the legal limit in their possession. Fortunately, sentiment in these counties is changing and many now see the danger in allowing salmon to be taken by means of a spear during the spawning season. It is to be hoped that there will be sufficient sentiment to make possible a change in the law during the present session of the legislature.

BLUE JAY HUNT IN SAN BENITO COUNTY.

Several years ago blue jay hunts were in vogue, but more recently little attention has been paid to the bird accused by the sportsmen of destroying quail's eggs. Of late, however, a well organized blue jay hunt was held at Hollister, California. Sixty sportsmen were divided into two rival teams and a week chosen for the hunt. When the final count of birds was made at the end of the week the total showed 1531 blue jays. One team outdistanced the other by 210 birds and this winning team were the guests at a big barbecue held by the other team. One hunter bagged 233, and the second best was 139.

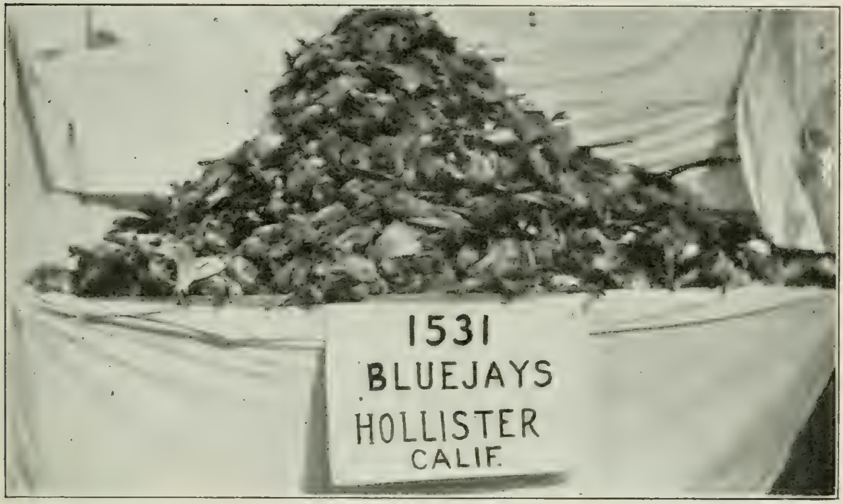

FIG. 38. The result of a blue jay hunt at Hollister, California. An organized blue jay hunt by sportsmen of the region netted 1531 blue jays in one week.

Whether such organized blue jay hunts are beneficial to the interests of game and other birds is still doubtful. That the blue jay deserves to be placed on the black list few will deny, but that blue jays good and bad, and there are good blue jays, should be killed off in large numbers is a question. Whether blue jays are actually as destructive to quail as to tree nesting birds is also something that still has to be proved. Doubtless, many arguments can be given on both sides, and the thing which is needed is more evidence. When those engaged in such a hunt spend as much energy in trying to determine the food of the blue jay as they do in making a large kill of birds a solution of the problem will be forthcoming.

MORE FINES FOR HUNTING OUT OF SEASON.

Apprehended for shooting four pintail ducks out of season, a Missouri hunter on March 7, 1921, was fined $200 and costs by Federal Judge Van Valkenburg, sitting at St. Joseph, Missouri. This sentence follows closely upon the conviction of a hunter in New Jersey before a federal judge by whom he was fined $200 and costs and sentenced to jail for ten days.

The spring flight of migratory birds is at its height during April, and the Biological Survey of the United States Department of Agriculture is putting forth every effort to see that they are permitted to go north to their nesting grounds unmolested. Due to the active cooperation of federal game wardens and state authorities, fewer violations of the federal law are occurring this spring than formerly. Nevertheless, some unscrupulous hunters are taking a chance; arrests for shooting out of season are being made by the game wardens and convictions are being obtained in nearly all cases.

MORE AND BETTER FUR.

"The demand for fur is far greater than can be met. Evidently the time is at hand when steps should be taken to increase and improve the fur supply. Trappers, dealers, manufacturers, and wearers, possessing in the aggregate a tremendous moral and financial influence, want more and better fur.

"Among the bad practices which have reduced the number of fur bearers are: (1) Using poison, which kills many animals that are not found before their skins are spoiled; (2) smoking animals out of their dens, which often suffocates them instead of forcing them out; (3) destroying dens, which either leaves the animals without suitable places in which to rear their young or drives them out of the neighborhood altogether; (4) trapping early in fall, which catches animals having small, unprime pelts before they are old enough to be suspicious of traps; and (5) trapping late in spring, which destroys breeding females with young.

"If no early or late trapping were done there would be fewer animals taken, but on the other hand the value of the catch and the number of animals left to breed another season would be far greater. Skins are prime for about two months after the molt is completed, and during this time they have no dark spots on the flesh side. They are worth much more when prime (. . . .) than when unprime (. . . .). Muskrat and beaver pelts are best in February and March, while those of other fur bearers are best from late in November till about the end of January."—Yrbk. U. S. Dept. Agri. 1919, Separate 823.

RAINBOW TROUT IN HAWAII.

In the Fisheries Service Bulletin, No. 69, issued February 1, 1921, Mr. H. L. Kelly, a former assistant of the Bureau of Fisheries and now the executive officer of the Fish and Game Commission of the Territory of Hawaii, gives an interesting report on the rainbow trout resulting from eggs supplied by the Bureau of Fisheries in 1919. Before making an application for another shipment of eggs to be hatched and planted on government reserves, Mr. Kelly went to Kauai to determine how the trout planted in the streams of the island were thriving. He found the people enthusiastic over the species and in the streams which had been stocked many trout were seen. Some of the fish were caught. The largest measured 7⅜ inches and others 5⅞ inches. These were taken exactly six months after planting. Requests were made for plantings in the mountain streams of the islands of Molokai and Maui. Their beautiful coloration and rapid rate of growth are prime factors in the success of the importation experiment to the sportsman and the fishculturist alike of Hawaii.

A DECLINE IN THE CONSUMPTION OF FISH.

"How are we to meet the decline in the consumption of fish and the resultant hardship on the fishing industry of the United States?"—is the question of the United States Bureau of Fisheries. During the period of the war the consumption of fishery products grew to considerable extent, which resulted in an expansion of facilities for the capture, preservation and marketing of these products. Despite the more adequate facilities for supply and the general advancing costs of materials and labor, there was a decline in the fishing industry.

Not only on the eastern coast is this the case but it would appear to be true to a certain extent in the west as well, as is demonstrated by a graph published in the 1920 Biennial Report of the California Fish and Game Commission giving a comparison of fish of all kinds packed in northern and southern California. A slight decline in the total number of cases of fish packed is shown by the following figures:

	1918	1919
Southern	1,385,202	1,166,435
Northern	729,100	905,206
Total	2,114,302	2,071,641

1918	2,114,302
1919	2,071,641
	42,661

However, in California, the salmon, and particularly the sardine catch, has steadily increased, as stated for the period 1917-1919, yet the estimated 1920 pack of canned salmon in the United States, including Alaska, is about 3½ million cases less than in 1917 and includes about 2½ million cases of the cheaper grades (pink and chum), which it is reported are being offered for sale for less than the cost of production and can be sold with profit by the retailer at a low price. The canners of sardines and the cheaper grades of tuna are confronted with similar difficulties.

The problem is indeed one of importance, for aside from the fact that fish is our cheapest and best source of natural food supply the fishermen are, most of them, small, individual producers with little or no training for a change of livelihood and these men will suffer, if the industry is allowed thus to decline.

accidents during the open season, as well as being a conservation measure. In 1917, twenty-eight fatal hunting accidents occurred in Michigan and Wisconsin. Out of this total, twenty-two occurred in Michigan as against only six in Wisconsin. The reason for the disparity was again laid to the fact that bucks only were allowed to be killed by deer hunters in Wisconsin, while in Michigan the big game hunters were allowed to kill without waiting to see the horns.

And so it continues to be demonstrated that the buck law in California and other states is largely responsible for the reduction in the number of hunting accidents.

Fig. 39. Fishing on the north fork of the Feather River. The trout season opened April 1, as usual. Photograph by F. A. Farnum.

BUCK LAW DECREASES HUNTING ACCIDENTS IN NEW YORK.

Quoting from the Conservationist for December, 1920: "The deer hunting season of 1920 closed with only one fatality due to a man being shot in mistake for a deer. Last year there were nine deaths from this cause, during a season when both bucks and does could be legally shot. Restoration of the buck law, and the requirement that a hunter look for horns before he shoots, is unquestionably to be thanked for the low mortality this year."

The buck law is one of the prime factors in reducing the number of hunting

A CONSERVATION READER FOR CALIFORNIA PUBLIC SCHOOLS.

"The wave of enthusiasm for the conservation of our natural resources must reach the children or it will expend much of its force uselessly." With this end in view, H. W. Fairbanks of Berkeley, California, who is the author of many text books on geography, has written a Conservation Reader.* The book brings out in a simple and interesting manner the principles of conservation. After introductory chapters giving a contrast between the past and the present, the conservation of soils, water, trees, forests, wild flowers, coal, oil, gas, aquatic animals, and birds, is outlined. The book is illustrated with two colored plates furnished by the National Association of Audubon Societies and with various reproductions of photographs.

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*Fairbanks, H. W., 1920. Conservation Reader (World Book Co., N. Y.) VI, 216 pages, illustrated.

"The movement for the preservation of natural resources can succeed only with the establishment of an enlightened public sentiment on the subject. To create and maintain such a sentiment is the proper work of the schools." The use of this conservation reader in the schools should help greatly in developing the right attitude toward natural resources and the consequent attainment of proper conservation of them.

PRESIDENT HARDING IN SYMPATHY WITH WILD LIFE CONSERVATION.

Mr. T. G. Pearson, President of the National Association of Audubon Societies, in answer to a telegram, received the following telegram from President Harding, who was at the time President-elect.

"I am fully in favor of a policy which will guard the integrity of our national parks and our bird reservations. I favor the enforcement of our treaty with Canada for the protection of valuable migratory birds. Please accept my greetings to your Association." (Signed)

WARREN G. HARDING.

Those who are interested in our national parks and in the conservation of our wild life take great satisfaction in the expressed attitude of President Harding.

FUR-BEARERS PROTECTED IN TRINITY REFUGE.

Game Refuge No. 1-D has been closed to trapping except for coyotes, mountain lions and bobcats. This restriction will bring about the same object with reference to fur-bearers as that attained for deer. The refuge is an ideal one for this purpose and if the law can be enforced and the predatory animals exterminated, it is absolutely certain that these species will be preserved forever, and that to a large degree the overflow can be legitimately trapped. Similar provisions for preserving fur-bearers should be applied to other refuges.—E. V. Jotter, Weaverville, California.

THE FUR SUPPLY AND ITS MAINTENANCE.

Mr. Ned Dearborn, Assistant Biologist, Bureau of Biological Survey, has recently written a pamphlet entitled "Maintenance of the Fur Supply."* In introducing the subject of his paper he says, "to direct attention to the great commercial importance of fur; to emphasize the need of maintaining the supply, which lately has been declining at an alarming rate; and to point out ways by which this supply may not only be maintained as to quantity but improved as to quality, is the purpose of this circular.

"The subject is discussed from the viewpoint of the farmer, to whom fur-bearing animals, if rightly managed, will be a source of interest and profit."

"The commercial history of America begins with fur, and from the early days down to the present this has been an important article in our domestic and foreign trade."

The World War has changed the center of the world fur trade from Europe to the United States, and the center of manufacture in the United States is New York City or the near vicinity. The United States has learned the art of dressing and dyeing the skins, as is demonstrated by the drop of forty per cent in the ratio of dressed and raw skins imported into the country. In 1914, dressed skins imported were worth $3,500,000, while raw skins imported were worth $7,500,000. In 1919, $4,000,000 worth of dressed skins were imported, as against $69,000,000 worth of raw skins.

"A concrete example of the rise in fur prices is afforded by the actual record of one man's fur-lined overcoat. This coat, lined with mink, in 1913 cost $500. After wearing the coat two years the owner sold the mink lining for $1,000 and replaced it with nutria at a cost of $150. Two years later, in 1917, he had the nutria lining removed and sold it for $250. A muskrat lining was then put in the coat at a cost of $55, which, in 1919, was in turn removed and sold for $300. The original purchaser still has the shell."

Although the price of furs is bound to drop to a certain extent, the fur dealers are not uneasy. The use of fur is being widely exploited—is being advertised for summer use as well as for winter—yet, there are two important factors to be reckoned with: (1) About one-half of the skins disposed of at American auction sales are of foreign origin. (2) The supply of furs is waning to the extent that if the present condition should continue for a few years the supply in settled districts would come to an end.

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*U. S. Dept. Agric., Dept. Circ. 135, Nov., 1920.

The following remedies for the situation are pointed out by Mr. Dearborn:

(1) All trappers should be licensed at a nominal fee and at the end of the trapping season should turn in a complete report of the skins taken. This report to be published for the benefit of the public.

(2) Farmers should be made to appreciate the possibilities of this source of income. They should know that although most of the important small fur-bearers are carniverous, few of them are destroyers of poultry. "Among fur animals, as among men, the proportion of criminals is small." Skunk-proof poultry yards should be installed, and the subsequent value of enticing the skunk to the farmer's land to destroy the rodents advocated.

Further emphasis should be placed on this natural source of income to the farmer, from animals which he neither has to feed nor shelter, so long as he recognizes the value of preserving their dens and killing them with discretion.

(3) The wisdom of killing fur-bearers only when the peltries are prime is forcefully brought out to the farmer by the associative argument, namely, that it is just as short-sighted for the farmer or trapper to kill fur-bearers before the peltries are prime as it is to harvest crops before they are ripe or when they are overripe. Hence, the value of limiting the trapping to a two months open season which is believed to be the most effective and efficient means of obtaining results.

(4) The importance of having fur animal preserves and of domesticating the animals is of moment. Now that the characters of North American animals and their geographical distribution are well known, the production of superior fur should be much more possible.

(5) Animal dens should be protected, and the knowledge of the local attachment of animals used to good advantage. The use of poison, smoke, gas, or fumes in taking fur-bearing animals should be prohibited.

Mr. Dearborn's paper is of importance to Californians for he points out that in this state the asset value of wild fur-bearers to the people of the state has been estimated at $7,125,000. The annual catch of fur in the state brings about four per cent of this huge sum. "By proper conservation it might readily be doubled." Therefore, the value of encouraging and promoting the fur industry along the right channels at this embryonic period in its development would seem most advantageous.

CAMP SANITATION.

Are you going camping this summer? The mountains of California constitute one of the most delightful of recreation areas, and an outing there may be most healthful and enjoyable if proper use is made of the opportunities offered. Proper use means, in a very important degree, good sanitation. If you take an outing you will find that your pleasure is marred when you discover evidences of careless habits of other campers. Remember that you are one of many thousands of campers that go to the mountains during a season, and that all have a right to expect you to avoid defiling the pleasure ground that is theirs as well as yours. Remember ,too, that these mountains are the catchment areas for drinking water supplies of many thousands of people and that the purity of these supplies depends very largely upon the efforts of yourself and other campers to practice intelligent sanitation.

The principles of good mountain sanitation are simple and their practice is not more burdensome than maintaining customary cleanliness around home. At home the person of common decency does not tolerate an accumulation in his yard of cans, bottles, papers, garbage and fecal matter, yet why is it that one may frequently see an otherwise attractive spot in the mountains littered with these things? Is it because the camp ground is only a temporary stopping place and campers lack the neighborliness to clean up their own refuse out of kindness for those who follow? Is it that same return-to-nature, otherwise carelessness, that on a camping expedition contents a man to go a week or two without a shave? It is thoughtlessness, and carelessness, perhaps laziness, but no part of nature.

The principles of good mountain sanitation are simple. Burn or bury all refuse and use care not to contaminate streams. There you have a complete program for keeping our recreation areas clean. Take a small shovel and some matches with you on your camping trip and use them with prudence. They will be useful for other than sanitary purposes.

When you build your camp fire burn your waste paper and when the meal is finished burn your garbage. Bury these materials if you do not have a camp fire; don't leave them for the next fellow to dispose of. Bury also your unburnable refuse, such as cans and bottles, or throw them into the underbrush well out of sight. Practice the ordinary principles of good housekeeping.

"Leave your camp as you would like to find it. Keep the pleasure grounds of America clean."—California State Board of Health.

NEW YORK'S ANNUAL GAME DIVIDEND.

Beginning in 1919 all owners of hunting licenses in the State of New York were required to report the game killed for the preceding year. The statistics compiled show that there were reported 465,590 cottontail rabbits; ducks taking a fifth place in the kill showing a total of 109,663; male deer totaled 8,293. The grand total of game taken in 1918 was 1,526,960.

The game and fur-bearing animals of New York State, if capitalized, are worth not less than $53,000,000; they return an annual dividend of more than $3,200,000; and they cost the state for their protection and increase the nominal sum of $182,000. This cost of protection and increase is thus less than six per cent of the annual dividend.

FACTS OF CURRENT INTEREST.

In 1920, Trinity County spent $1,323 in controlling the coyote. A bounty of $3 each was paid on 441 coyotes on which the reward was claimed.

* * *

Salmon have appeared early this season, 150 pounds having been taken by trawling near the Farallones on March 3, 1921. In 1919 and 1920 the first salmon were caught after the middle of March.

* * *

Although some of the ayu eggs imported from Japan hatched, they were so weakened by fungus that none of them survived.

* * *

Deputies Carpenter and Britton arrested two men at Arbuckle during March who had in their machine 184 ducks. They were presumably on their way to San Francisco to dispose of this illegal game. Both men were taken before Justice Jones at Williams, who sentenced them to sixty and ninety days, respectively, in the county jail.

* * *

A bill before the legislature provides for a limit of ten abalones per day. This would effectively prohibit the commercialization of this sea food.

* * *

Large shipments of edible crabs have been arriving in San Francisco. On March 12, 1921, a shipment amounting to four truckloads was received.

* * *

No less than three bills which would abolish the present Fish and Game Commission have been introduced in the legislature. Two of them would make fish and game work depend upon appropriations by the legislature.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

SEASON PROSPECTS.

As outlined in the January number of CALIFORNIA FISH AND GAME, the past season was a very successful one from the standpoint of the number of trout fry reared, the quality of the fish planted and the systematic manner in which they were distributed, when the difficulties encountered in the prosecution of the work, due to the extreme drought, are taken into consideration.

Plans are under way for still further improvements in the fish distribution work during the coming season. Within the next two weeks all applicants, who received trout fry last season, will be sent application blanks and will be requested to file their applications prior to the thirtieth day of April. Judging from recent correspondence with many of last season's applicants, there is going to be an unprecedented demand for trout fry this coming season. This is due to several reasons. There were very few losses of fish last season. The success of fish planting during the past few seasons due to our closer cooperation with the applicants and to sending of special messengers, trained in fish planting work, to assist and instruct in the best methods of handling and planting the fry is beginning to show more satisfactory results and the public is coming more generally to realize that it is only by extensive restocking of their fishing streams and lakes each year, that they may prevent depletion due to excessive fishing.

Public association of anglers, resort owners and individuals, who are interested in one way or another in fishing, are taking more interest in the work, as the efficiency of our methods is demonstrated to them. Then to, Boards of Supervisors, Chambers of Commerce and public officials, having the business interests of their communities at heart, are coming to realize that fish and game are among the best assets to a community, and that it is only by keeping the streams stocked with trout fry from the state hatcheries that the depletion of the fish in the streams and lakes can be avoided. They therefore consider, from a business standpoint, that appropriations of adequate amounts from their funds to provide for proper distribution of the fish allotted to them by the Commission is money well spent.

During the past several years of drought, it has been extremely difficult for us to obtain a sufficient number of trout eggs to supply all of the fry required to adequately stock the waters of the state, despite the rapid increase in the extent of our operations. This season we hope to materially increase our output of trout fry. No effort has been spared to make the coming season the most productive of results that we have ever had. The older egg-collecting stations have been enlarged and improved to handle a greater output and hatcheries have been equipped to take care of all of the eggs which it is possible to secure.

The new Lake Tahoe Hatchery, as previously mentioned, has been finished and is ready for occupancy. The Mount Tallac Hatchery will be opened as usual about the middle of March and in addition to the egg-collecting operations, which have been carried on in past years at the mouth of Taylor Creek, a new egg-collecting station will be operated on the upper Truckee River.

Arrangements are being made to establish an experimental hatchery near Blairsden, in Plumas County, to take care of the requirements of the Feather River district, as well as the North Yuba River district near Sierra City. If this station can be successfully established, it will eliminate to a very great extent, the necessity of transporting trout fry for stocking the streams in Plumas County from the Mount Shasta Hatchery. This long haul is very hard on the fish and is very expensive. If rainbow trout can be successfully reared at the Feather River, near Blairsden, which is centrally located, they can be distributed to far better advantage and with much less expense than to ship them from so great a distance as Sisson.

By the establishment of this hatchery that section of the Yuba River in the vicinity of Sierra City can be handled to better advantage, as the long haul from Sisson to Nevada City and thence by auto truck over the heavy grades along the Yuba River will be eliminated.

Operations at the Mount Shasta Hatchery and the various egg-collecting stations along the Klamath River are in full swing. While it is too early in the season to state definitely the number of eggs, which we can expect from the Klamath River stations, we have every reason to believe that the take will be very satisfactory. The first of the rainbow trout are "running" in Bogus Creek, Camp Creek and Fall Creek and something over a million of eggs have been taken to date. The run of fish in Cottonwood Creek is somewhat later, but indications are for a successful take of eggs at the Hornbrook Station. The salmon fry which are being hatched at Mount Shasta and Fall Creek hatcheries are doing nicely and will furnish a fine lot of fry for distribution this spring and for placing in the large salmon rearing lakes where they are held throughout the summer months and then liberated in the upper reaches of the Sacramento and Klamath rivers next fall.

Steelhead egg-collecting operations are under way at the Scott Creek and Snow Mountain collecting stations and indications are that a successful take of eggs at both places will be secured.

Ukiah Hatchery is in readiness for the reception of the steelhead eggs from the Snow Mountain Station.

Brookdale Hatchery is also open and prepared for operations. Extensive re-

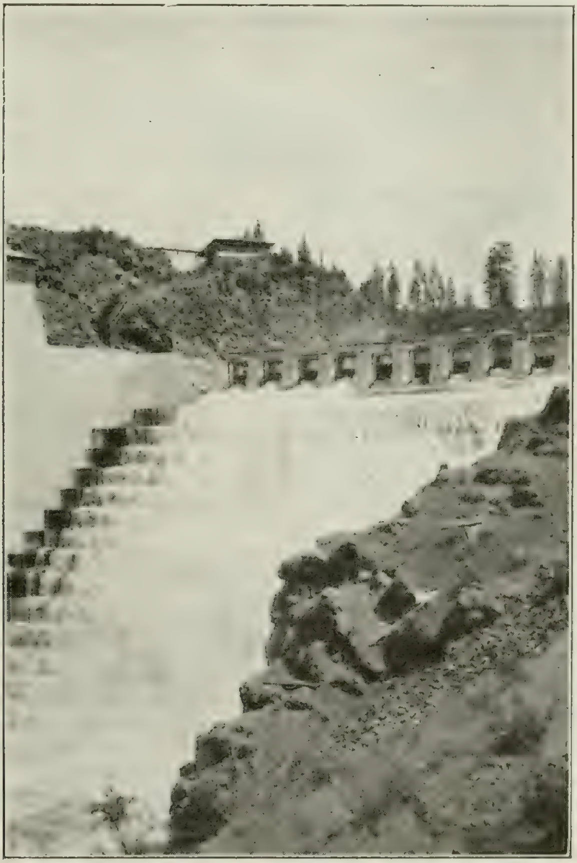

FIG. 40. Copco Dam on the Klamath River. This dam is so high that a fish ladder was not feasible. Consequently, the California-Oregon Power Company was compelled to build a fish hatchery in lieu of a fishway. Photograph by C. Westerfeld.

pairs to the water supply system have been made and the station generally is in first class condition. Over three-quarters of a million of steelhead eggs have been taken at the Scott Creek Station to date and are being cared for at Brookdale. A half million salmon fry are being reared at the Fort Seward Hatchery for distribution this spring in Eel River, Mad River and tributaries of Humboldt Bay. The hatchery is all ready for the reception of steelhead trout eggs from Ukiah Hatchery.

Domingo Springs, Almanor and Clear Creek hatcheries will be open for operations during the middle and latter part of March.

A crew of fishculturists will be sent into the Big Bear Lake district within the next two weeks and operations will be commenced as soon as the fish start "running" at the North Creek Station.

The Kaweah Hatchery will open for operations shortly after the first of April.

Wawona Hatchery will, as usual, be opened sometime during April.

The San Joaquin River Experimental Station is still in operation. The weather has been extremely cold, the water being close to the freezing point for days at a time and development of the salmon eggs has been very greatly retarded.

Three hundred thousand Loch Leven trout eggs were shipped during the latter part of December to the Mount Whitney Hatchery and the resulting fry are doing nicely. Everything at this station is in readiness for the commencement of the season's operations. The seasonal work on the grounds has been progressing nicely and the gardens promise to be in even better shape than they were last season.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

SHALL WE USE FOOD FISH FOR FERTILIZER?

With a poor market for canned fishery products and a strong market for fertilizer and poultry foods, a difficult problem confronts the Fish and Game Commission and the state legislature. Canneries at Monterey and in southern California are asking for permits to catch sardines in quantity for use at reduction plants rather than for use in the canneries. So great is the demand made by the canneries that a bill has been introduced into the legislature which would allow the use of food fishes for fertilizer and poultry products. Up to this time, only ten to twenty per cent of the catch, which was considered as "overcatch," has been utilized in the reduction plants. It is feared that the sardine has already suffered from over fishing, owing to the great demand of the past few years, and that a further toll levied would deplete the supply. Present plans to continue fishing obviates the chance of the species to recuperate and assure an abundance of fish in the future.

In order to test the present law which allows only the spoiled fish and the overcatch to be utilized in the reduction plants, cannery men of southern California have instituted a test case which is now before the courts.

FISHERIES, 1920.

During the year 1920 there were 208,342,816 pounds of fresh fish and 6,423,911 pounds of mollusks and crustaceans, making a grand total of 214,766,727 pounds of fishery products, taken in the waters of this state. The catch for 1920 shows considerable decrease in the totals in comparison with the catch for 1919 which was 262,258,511 pounds. The sardine catch showed the greatest decrease, which was approximately 35,000,000 pounds less than during 1919. Salmon, yellowtail, sole, squid and clams also declined, while the catch of albacore showed an increase of about 5,000,000 pounds.

The decreased catch of sardines was on account of the poor demand for the canned and salted products and canneries did not operate their plants to full capacity during the year and many of those plants operating closed down early in the fall. During the spring of 1919 there were great quantities of sardines used in reduction plants for fish meal. In the summer of 1919, a law went into effect preventing the use of edible fish in reduction plants and during 1920 there was no straight fishing for sardines for reduction purposes.

The salmon catch in the state shows a decrease of approximately two million pounds, the total catch for the year being 11,138,693 pounds. Along the coast north of San Francisco the catch was about the same as the previous year, some particular localities showing slight increase, while other districts show a small decrease. The decrease in the catch was on Monterey Bay and the Sacramento River. The Monterey Bay catch was 1,300,000 pounds less than in 1919, which was by no means a good year for that district. The Sacramento River catch declined about 700,000 pounds. The water was very low in the Sacramento River during August and September and no doubt this fact, together with the poor quality of salmon and low price, had considerable effect on the catch as a number of the fishermen laid up their boats and stopped fishing some time before the season closed on September 24.

During 1920 there were 1,941,984 cases of fish canned. Of this amount, 1,062,996 cases were sardines and 835,645 cases were tuna, these two varieties of fish being the principal fish used for canning purposes in this state. The tuna pack for 1920 was greater than during the previous year, while the sardine pack was lighter. The total pack of all varieties canned in 1920 was about 130,000 cases less than during 1919.

Complete statistics of the fisheries for the year 1920 will be published at a later date and should show some very interesting data.—S. H. D.

SACRAMENTO RIVER SALMON MARKING, 1920.

When salmon hatching on a large scale began on this coast it was the custom to liberate the fry in the streams as soon as the yolk sacks had been absorbed. Of late years the fry have been held for longer periods of time at the hatcheries on the belief that larger fish are better able to take care of themselves when liberated in the streams. The small fry in the hatchery troughs are of necessity crowded and are accustomed to being fed at regular intervals. It is thought that planting these small fry in a stream is too sudden a change and that too many fall a prey to enemies before they learn to avoid dangers and forage for themselves. To overcome this difficulty the small fry are transferred from the crowded hatchery trough to a large pond or lake where they have more room and are often able to find some natural food. From the pond the fry may be transferred to the stream when they are considered to be of sufficient size or when the height of water in the stream is considered most favorable.

Proof of the relative success of different times of liberating has been lacking, partially due to the difficulty of securing data. One method of securing this proof is to mark some of the young fish from two or more lots of fry liberated at different times. A comparison of the number from each lot recovered when they return to spawn would throw some light on the success of the different methods of liberating. The great difficulty in all such marking experiments is that so few marked fish are recovered. In the cleaning sheds large numbers of fish must be prepared for market in a short time and the fish are handled so rapidly that the missing fins of marked fish are either not noticed or are neglected, so that time is not taken to measure the fish, to take a sample of the scales and send the data to the office of the Fish and Game Commission. It is impractical to have a representative of the Commission at all of the fish sheds while fish are being received.

Another difficulty is the possible objection to marking fish by the removal of fins or with metal tags in that one is never sure that the behavior of such marked fish is typical of the behavior of unmarked fish of the same brood. Nevertheless some valuable data may be secured from such marking experiments. No other method has yet been devised for securing knowledge of the migrations of salmon in the ocean. In this connection, the first article in the January, 1921, number of this magazine is of special interest in showing that marked fish liberated in the Sacramento River were recovered not only in the Sacramento gill nets but also by trolling at such widely separated points as Monterey and Shelter Cove.

At a conference (September 8, 1920) between representatives of the California Fish and Game Commission it was decided to try another King salmon marking experiment using Sacramento River eggs and liberating in the Sacramento. The object of the experiment was threefold, first, to contribute to the knowledge of ocean migrations and, second, to throw some light on scale readings by comparing the hatchery lake growth with the normal stream growth. The third and chief object was the comparison of three methods of liberating fry: liberating (1) large fry in the fall, (2) yearlings in the spring, and (3) small fry in the spring. To accomplish this it was planned to mark three batches of fish corresponding to the three enumerated above. Of the first two batches of fry from November, 1919, eggs, the first was to be marked and liberated in September, 1920, and the second in the spring of 1921. The third, from the fall of 1920 eggs, to be marked and liberated in the spring of 1921.

The first batch was marked as planned but the remainder of the experiment was unexpectedly upset by the behavior of the Sacramento River. These marked fish were to have been liberated sometime in November of 1920, but the fall floods of the Sacramento broke levees and it was feared that too great a loss of young fry would result if the liberation were made during the time of floods, so it was necessary to hold the fish over winter. However, the marking already completed should contribute something toward determining ocean migrations and possibly scale growth characteristics. The following is an account of the marking of the first batch of salmon fry.

Source of Eggs and Hatching.

The King or Chinook salmon eggs were taken by the United States Bureau of Fisheries at its substation on Mill Creek, a tributary of the Sacramento River, Tehama County, California. The eggs were taken the latter part of November, 1919, eyed at Mill Creek and sent in a shipment of 1,258,000 to Sisson, California, where they were received February 10, 1920. They were hatched the latter part of February at the Mount Shasta Hatchery, a state hatchery at Sisson. After several weeks in the troughs the fry were transferred on May 27, 1920, to Klink's Lake, one of the three lakes at the hatchery used for holding fry before the final planting in the stream. Here they remained till the end of September when part of them were returned to the hatchery for the purpose of marking.

Size of Fry.

These fry in the latter part of September, 1920, were ten months old reckoning from the time the eggs were collected or seven months from the time of hatching and had spent four months in Klink's Lake. A sample of 120 of these fish taken at random on September 27 showed an average length of 7.9 centimeters, or 3.1 inches. The greatest extremes in length of fish from this sample were 5.8 to 10.8 centimeters, or 2.3 to 4.25 inches. Other extreme cases were found where the range was from 4.5 to 13.0 centimeters, or 1.8 to 5.1 inches. The measurements were made from the tip of the nose to the tip of the central rays of the tail fin.

Mark and Number Marked.

The mark used was the removal of the adipose fin and the posterior half of the dorsal fin by clipping with cuticle nippers. Twenty thousand fry were marked, the marking being started on September 25 and finished on October 4, 1920. The marking was done by C. L. Frame of the Department of Fish Culture and W. L. Scofield of the Departmentof Commercial Fisheries.—W. L. SCOFIELD.

A NEW SPECIES OF FISH FROM SANTA CATALINA ISLAND.

A specimen secured from the Avalon Aquarium has been described as a new species by Carl L. Hubbs, of the Museum of Zoology, of the University of Michigan.* This new fish is of particular interest because it has been named for Mr. William Francis Thompson, in charge of the State Fisheries Laboratory, of the California Fish and Game Commission, who is the author of many important works on marine fishes.

Sciaena thompsoni is most similar to three Panamaic species, but has fewer dorsal fin-rays and longer caudal peduncle, as well as other differences.

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*Hubbs, Carl L. 1921. Description of a new Sciænoid fish from Santa Catalina Island, California. Occ. papers Museum of Zoology. No. 92, pp. 1–3, 1 pl.

BARBLESS FISH HOOKS.

Certain sportsmen's angling clubs are advocating the use of barbless hooks for catching fish, arguing that it is more sportsmanlike for it gives the fish a chance for its life. Besides its being a more creditable performance, they say, to catch fish with a barbless hook, the undersized fish when returned to the water will be more apt to survive as they are hurt very little.

It is interesting to note here that the commercial fishermen in fishing for long-finned tuna, skipjack and bonito in southern California use principally barbless hooks. The motive in their case is not to give the fish a better chance for their life, but to enable them to catch them faster, for the barbless hook is more quickly extracted and time is thus saved when the fish are coming fast.

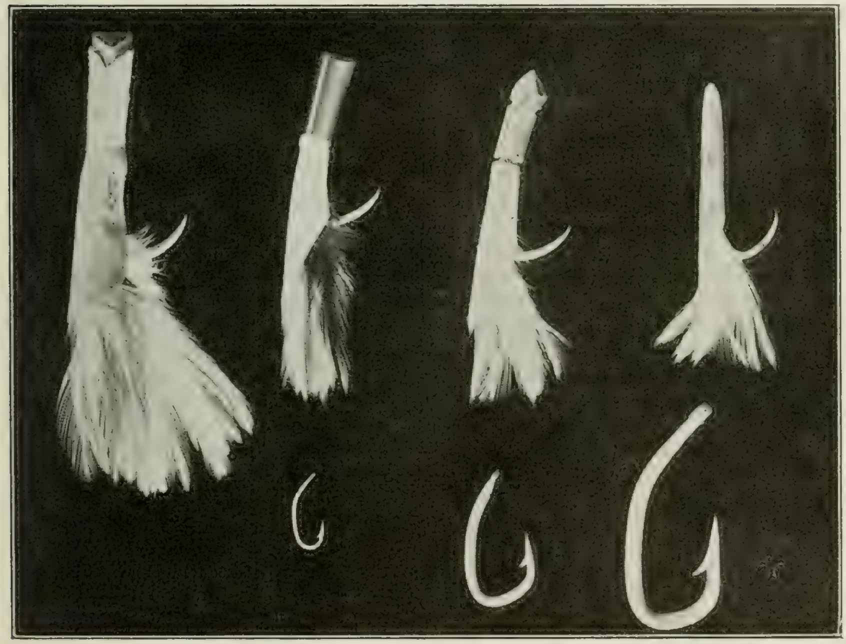

Fig. 41. Barbless hooks used in the capture of tuna. Photograph by H. C. Bryant.

LIFE HISTORY NOTES.

THE PORCUPINE AS FOOD.

An animal, purely a vegetarian, that plays great havoc with gardens all through this country, is the porcupine. Sometimes, all of the garden stuff on outlying ranches in this section is completely destroyed by this pest. One of our rangers trapped a good many porcupines in his garden at a ranger station last summer, and he and his family used them to a considerable extent as food. I have eaten porcupine meat on several occasions during the past summer and found it to be quite palatable. Only for the fact that the meat is coarser in texture, one could imagine he was eating beef—provided of course, that the porcupine is young. An old porcupine is the toughest chewing imaginable—Wm. S. Brown, *Alturas, California.*

TREE SQUIRRELS INFESTED WITH SCABIES.

A dead California gray squirrel (*Sciurus griseus griseus*) was recently sent to the University of California by Deputy Euell Gray from Placerville, California, for post mortem, as it was afflicted with a disease which has been killing off great numbers of gray squirrels in the El Dorado National Forest. The disease was first noticed among the squirrels on the Georgetown Ridge in 1917. The gray squirrels were practically exterminated in this district. Since then, the disease has spread from this vicinity and is now most noticeable in the southeastern part of the county.

The first evidence of the disease is to be seen in a scaly or mangy appearance around the head and neck. This is followed by sores over the rest of the body and the hair falls off. Dead squirrels are to be found at the bases of trees and in streams of water.

Examination, by the veterinary and entomological departments of the University of California of the specimen sent in showed the disease to be a form of scabies. According to Professor Stanley B. Freeborn, the cause is to be found in a mite belonging to the genus *Notocdres*. These mites live in little tunnels dug in the skin and they eventually cause bad sores which weaken the animal to such an extent that death finally ensues. A closely related species found on the cat has recently been transmitted to the rabbit, horse, dog and man, always with difficulty and with no serious effect. Laboratory rabbits infested with a similar species of mite invariably die a more or less lingering death, if left untreated. Thorough washing followed by applications of sulphur ointment repeated three or four times, at intervals of five or six days, generally produces satisfactory cures in these animals, if taken early.

It is to be hoped that this epidemic will disappear, as do most epidemics of this kind.—H. C. BRYANT, *Berkeley, Calif.*

ANTELOPE SHOW INCREASE.

Prong-horn antelope (*Antilocapra americana*) near Mount Dome in Butte Creek Valley appear to be on the increase. Mr. Crawford, of Yreka, recently counted 108 animals near Mount Dome. This is an increase of sixteen head over the last count of these antelope. This increase is apparently due to the careful enforcement of the law which gives total protection to the antelope—J. O. MILLER, *Yreka, California.*

REPORTS.

SEIZURES—FISH AND GAME; ILLEGALLY USED FISHING APPARATUS.

Game.

Deer meat	141	pounds
Quail	253	
Ducks	797	
Doves—pigeons	9	
Rabbits—squirrels	2	
Pheasants	3	
Swan	1	
Mudhens	18	
Miscellaneous birds	80	
Deer hides	1	

Fish.

Striped bass	617	pounds
Halibut	1,000	pounds
Salmon	3,031	pounds
Young smelt	415	pounds
Trout	8	
Crabs	2,164	
Crab meat	30	pounds
Abalones	37	
Clams—Pismo	101	
Clams—cockle	232	pounds
Lobsters	811	
Illegal nets	9	

Searches.

Illegal fish and game	9

VIOLATIONS OF FISH AND GAME LAWS.

October 1, 1920, to December 31, 1920.

Game.

Offense	Number of arrests	Fines imposed
Hunting without license	47	$853 00
Hunting on posted grounds	4	130 00
Trapping without license	2	35 00
Deer—closed season—killing or possession	13	625 00
Does—spike bucks—fawns—killing or possession	4	225 00
Illegal deer hides	2	30 00
Brush rabbits—squirrels—closed season—killing or possession	5	150 00
Quail—closed season—excess limit—killing or possession	35	1,018 00
Doves—closed season—killing or possession	1	25 00
Ducks—excess limit—closed season—killing or possession	14	480 00
Mudhens—closed season—killing or possession	3	75 00
Wild pheasants—swan—closed season—killing or possession	6	275 00
Non-game birds—killing or possession	33	660 00
Protected shore birds—killing or possession	15	400 00
Bear—closed season—killing or possession	2	20 00
Shooting from power boat	8	35 00
Night hunting	17	550 00
Destroying state evidence	1	30 00
Total game violations	212	$5,646 00

Fish.

Offense	Number of arrests	Fines imposed
Angling without license	6	$150 00
Fishing for profit without license	2	20 00
Clams—undersized—excess limit—taking or possession	16	375 00
Crabs—undersized—taking or possession	4	95 00
Abalones—undersized—excess limit—taking or possession	4	100 00
Lobsters—undersized—excess limit—taking or possession	10	170 00
Striped bass—under weight—offering for sale closed season—excess limit	6	140 00
Halibut—excess limit	1	50 00
Selling steelhead not properly tagged	1	75 00
Young fish—taking or possession	3	60 00
Fishing in restricted waters	1	----------
Illegal nets in restricted districts	6	200 00
Total fish violations	60	$1,435 00
Grand total fish and game violations	272	$7,081 00

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF OCTOBER, NOVEMBER, DECEMBER, 1920.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexican
Albacore											96,633		993	97,626	
Anchovies			60				20,350		96,081				14,170	130,661	
Barracuda								3,573	22,610	78,716	298,008	251	32,943	436,101	1,530,931
Bluefish								36	15,531					15,567	
Boccaccio							10,186	72,326	291,278					373,790	
Bonito								41	36	11,924	287,260		20,060	319,321	51,584
Carp				147	1,296	6,686								8,129	
Catfish		7,881		3,986		5,950								17,817	
Chilipepper								33,438	150,813					184,251	
Cultus cod	30						51,005	11,199	63,878					126,112	
Eels												180		180	
Flounders	406		44	583		3,451	15,877	875	640		554			22,430	
Grayfish						65	20,950	1,375	710		15,389	231	89,507	128,230	
Hake							58,057							58,057	
Halibut							1,242	38	285	27,463	175,427	2,036	38,564	245,055	574,468
Hardhead					197	270								467	
Herring	739		17,239			2,050	28,010							48,038	
Kingfish							671	18,814	11,500		57,257	672	1,520	90,434	48
Mackerel								2,175	123,404	6,406	683,247	7,248	12,713	835,193	10,824
Perch	4,302		15,648			3	22,653	1,000	1,005	41	10,708	1,119	1,995	58,474	4,950
Pike				42	433	1,994								2,469	
Pompano							459		51		7,705			8,215	
Rock bass										9	35,618	1,254	10,518	47,399	1,980
Rockfish	1,016						102,982	85,403	178,517	5,172	235,294	4,394	242,090	854,868	10,932
Sablefish							181,692							181,692	
Salmon	331,459		94	17,542		12,877	21		38					362,031	
Sand dabs							46,590	12,444	90		1,781			60,905	
Sardines						200	424,985	3,122,554	20,415,121		69,116		158,981	24,190,957	
Sculpin											12,629	95	2,195	14,919	
Sea bass—black										743	14,453		3,823	19,019	24,112
Sea bass—white			15,892				3,253	11,360	629	28,778	60,228	1,134	2,733	124,007	31,740
Sea trout							24						42	66	

Shad				78		755								833	
Shad—buck						88								88	
Sheepshead										85	1,772		2,037	3,894	
Skates							19,095		140		87			19,322	
Skipjack								84			730,775	77	588,409	1,319,345	
Smelt	7,467		3,527			320	3,842	1,391	26,895	6,444	50,603	93,293	7,895	201,677	13,002
Sole	33						594,119	237,756	1,161		10,764		947	844,780	530
Splittail					798	644								1,442	
Striped bass			24	9,782		91,609	1,873							103,288	
Stingaree													1,485	1,485	
Suckers					551									551	
Swordfish											2,598		370	2,968	
Tomcod							4,450	480						4,930	
Trout—steelhead	1,089													1,089	
Tuna											243,267	35	585,911	829,213	25,903
Tuna—bluefin											6,070			6,070	
Tuna—yellowfin											1,031,522			1,031,522	
Turbot			334											334	
Whitebait			542											542	
Whitefish											2,607	150	1,165	3,922	435
Yellowtail										991	994,762	1,663	182,790	1,180,206	96,935
Miscellaneous	851		6				10,234	31,418	4,194	46,297	8,433	581		102,044	
Total fish	347,392	7,881	53,410	32,160	3,275	126,932	1,622,650	3,617,810	21,404,607	213,069	5,144,567	114,416	2,003,856	34,722,025	2,381,374
Crustaceans—															
Crabs (doz.)	39		169				11,692	7						11,907	
Shrimps							73,697				681			74,378	
Spiny lobsters										29,584	93,079	3,077	33,565	159,305	281,878
Mollusks—															
Abalones									182,852	40,435				223,287	28,355
Clams—cockle	140		1,812											1,952	
Clams—mixed	5,355	36	6,719			804								12,914	
Clams—Pismo								75		52,139				52,214	
Clams—softshell			4,440			54,607	17,065							76,112	
Cuttlefish							1,572	130	6,483		17			8,202	
Mussels						76	288	125						489	
Oysters—															
Eastern (No.)			255,537				1,390,947							1,646,484	
Native			1,905											1,905	
Snails											60			60	
Squid									440		110			550	

All amounts shown in pounds unless otherwise specified.

STATEMENT OF EXPENDITURES.

Period from July 1, 1920, to January 31, 1921.

Administration:		
Commissioners	$ 310 68	
Executive offices	14,870 58	
Printing	3,259 87	
Research and publicity	3,533 79	
Accident and death claims	1,179 53	
		$23,154 45
Commercial fish culture and conservation:		
Superintendence	8,737 52	
Inspection and patrol	17,803 38	
Research	18,096 36	
Statistics	5,778 17	
Market fishing license commissions	299 50	
Propagation and distribution of salmon	16,748 52	
		$67,463 45
Sporting fish culture and conservation:		
Superintendence	9,137 87	
Printing	172 04	
Prosecutions and allowances	212 50	
Angling license commissions	11,734 60	
Fish exhibits	4,293 19	
General patrol—pro rata share:		
San Francisco District (40 per cent)	22,457 19	
Los Angeles District (40 per cent)	9,566 74	
Sacramento District (40 per cent)	16,842 10	
Propagation and distribution of trout	94,031 27	
		$168,447 50
Game conservation:		
Printing	199 83	
Prosecutions and allowances	957 98	
Hunting license commissions	18,078 90	
Mountain lion hunting (and bounties)	4,842 58	
General patrol—pro rata share:		
San Francisco District (60 per cent)	33,553 68	
Los Angeles District (60 per cent)	14,259 67	

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 7 SACRAMENTO, JULY, 1921 Number 3

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CALIFORNIA HAWKS: HOW TO IDENTIFY THEM.

By HAROLD C. BRYANT.

From being the most maligned of all birds, the hawks and owls are now coming to be recognized as among the most helpful to mankind. Members of this group have been continually persecuted because a few species have shown themselves to be destructive to domesticated birds and mammals. Each hawk and owl has been judged by circumstantial evidence, and prejudice has caused the good to suffer with the bad.

In recent years, the farmer has come to a realization of the great damage caused by ground squirrels, gophers and other rodents and he is willing that all the natural enemies of these pests should be encouraged. As a consequence, state laws protect the beneficial species of hawks and blacklist the destructive ones. Nevertheless, a beneficial hawk hanging on a roadside fence or tacked to the side of a barn is still a too prevalent sight. With the exact data on food habits that we now possess, there is no excuse for ignorance as to the economic value of each species.

In the hope of stimulating interest in the preservation of the beneficial raptores the following analysis of the destructive and beneficial hawks has been made, together with a field key, which, it is hoped, will make identification possible.

BIRDS OF PREY.

Birds of prey are recognized by strongly hooked bills with a soft skin, the ''cere,'' surrounding the nostrils, and by the large strong feet with flexible toe joints, and long, curved, sharp talons which are powerful weapons for grasping and killing prey. Of particular use are the latter in holding the prey while it is torn to pieces. In the vultures, which are carrion feeders, the talons are not so well developed. All have a swift, sure flight. Their whole structure betokens ''strength, activity, ferocity, and predatory nature.'' Although the above anatomical characteristics are held in common by all the raptores, yet a close study shows that the different species are grouped together because of like habits rather than because of like structure.

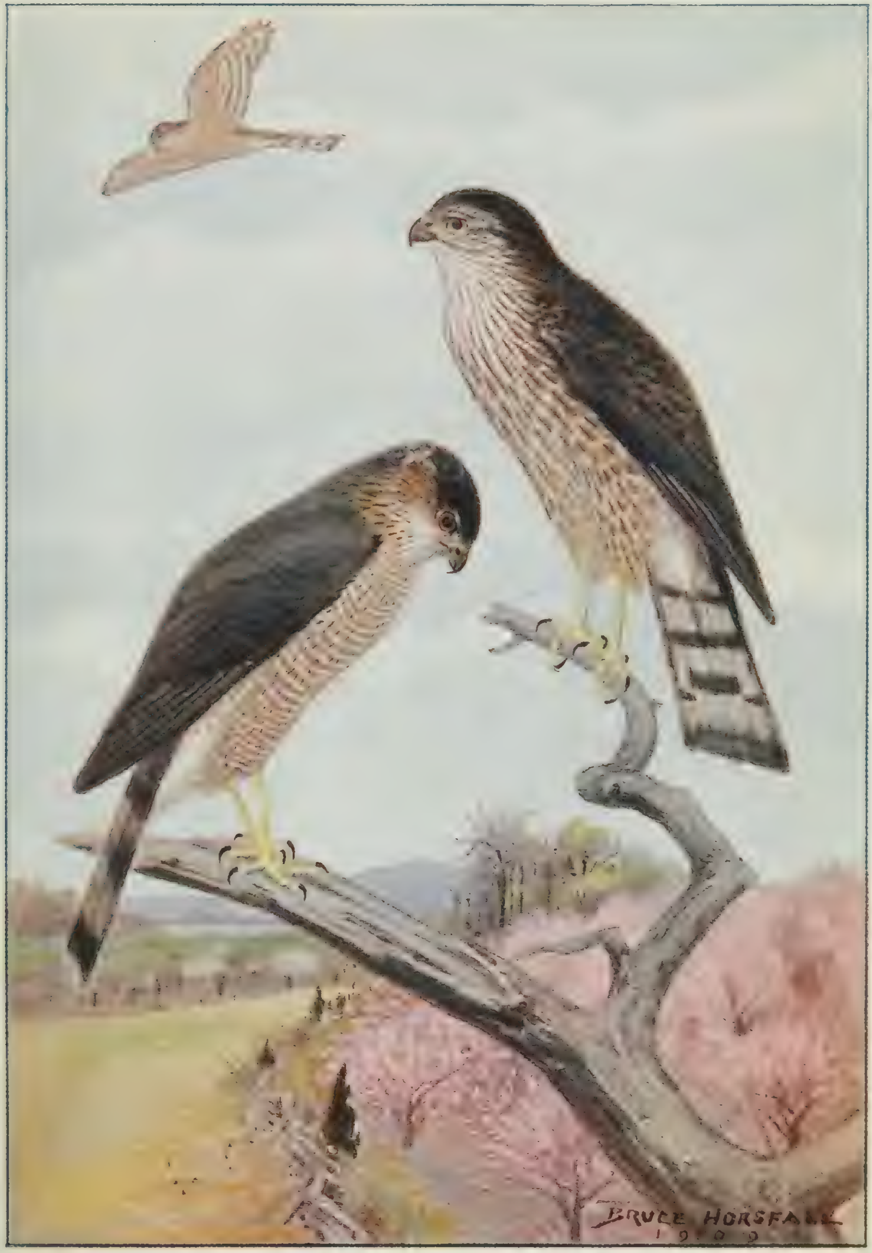
Hawks fly by day, and in the economy of nature owls take their place at night. The owls may be distinguished by their eyes being directed forward and by the disks of radiating feathers which surround the eyes. They are among the few birds which have binocular instead of monocular vision. Hawks have less fluffy plumage and smaller heads than owls.

The hawks are slow breeders, most of them laying but two eggs each season and rearing but one brood each year. The young grow very slowly and remain in the nest for a considerable period of time before developing the powers of flight.

Identification of hawks is oftentimes made difficult because the same species frequently has two color phases. Blackish or melanistic forms are of frequent occurence in several species of beneficial hawks. Since dark colored birds do not appear among the destructive bird eating hawks, it is safe to say that all black hawks are useful. Another means of discriminating between good and bad hawks is to be found in the seasonal occurrence; the destructive hawks are almost invariably winter visitants, consequently, the chances are that hawks shot in the summer are beneficial ones.

As a rule the sexes are colored alike. There is, however, a marked difference in size, the female being the larger. The fluffy juvenile plumage makes the young bird appear larger than the adult.

The food is made up chiefly of rodents and insects, and the birds gorge themselves whenever opportunity offers. Although the flesh is often picked from the bones, small animals are usually swallowed whole. Indigestible parts are often regurgitated in the form of pel-



SHARP-SHINNED HAWK

(Right Hand Figure, Immature Female; Left Hand Figure, Adult Male)

Order—Raptores
Family—Falconidæ
Genus—Accipiter
Species—Velox

National Association of Audubon Societies

lets. The hair, bones, and other elements in a pellet can be identified and a comprehensive idea of the food may be obtained by a study of such pellets.

KINDS OF HAWKS.

Hawks are usually divided into four main groups: The meadow hunters, known as *harriers* (represented by but one form, the marsh hawk); the woodland hawks, known as *accipiters;* the soaring hawks, the *buteos* and eagles; and the "long winged chasing" hawks, known as *falcons.* Sometimes the carrion feeders, known as *vultures*, are included.

THE BLACKLIST.

By far the larger number of hawks are beneficial. It is, therefore, better to know the villians than to attempt to know all of the beneficial species. Attention is accordingly called to the following hawks which may properly be blacklisted. State laws give these hawks no protection.

All of the destructive species belong to the third group, the *accipiters.* All are typical bird hawks with long tails, short rounded wings, comparatively small heads, and with a rapid, darting flight. In the open their flight consists of alternate flappings and sailings. Seldom, if ever, do they give any cry. All habitually frequent wooded or brushy areas. These birds usually watch for their prey from some vantage point and dart in among the trees or brush to secure it. In the hand, they are readily identified by their short broad wings, and slender unfeathered legs and feet.

Three of the destructive species are very much alike in coloration and habits, their main difference being in size. We can, therefore, speak of three editions of the "chicken hawk." The first is the small sized "chicken hawk" known as the "sharp-shinned hawk." (See plate 1.) The second is the medium sized bird and perhaps the best known of all those attacking poultry, the Cooper hawk, sometimes called the "bullet hawk," and rightly called a "chicken hawk." An additional field character, to that of size in distinguishing the sharp-shinned from the Cooper hawk, is to be found in the shape of the tail. The tail of the sharp-shinned hawk is square-ended, whereas, that of the Cooper hawk is rounded. The third is the larger species found only in the higher mountains and in the northern part of the state, the western goshawk. All three are sometimes dubbed "blue darters" because of their manner of hunting. Very often they capture their prey in mid-air. The adult goshawk can be recognized in the open by its bluish colored back and wings and barred breast, as constrasted with the striped or streaked breast of the Cooper and sharp-shinned hawk. The young of the goshawk, however, have streaked breasts and can easily be confused with the Cooper hawk.

The food of these three hawks is made up almost entirely of birds, the larger species feeding to a considerable extent on such game birds as quail and grouse, in fact, to such an extent that the Cooper hawk is often known as the "quail hawk" and the goshawk as the "grouse hawk." The Cooper hawk often attacks pigeons and returns day after day to claim a victim. Stomach examination has shown that this hawk feeds almost wholly upon wild birds and poultry. Of all the common hawks this is the most "audacious highwayman." It preys commonly on valley quail. In a nest of a pair of Cooper hawks in the San Jacinto mountains the remains of three chickens, a blue jay and a chipmunk were found (Grinnell and Swarth, 1913). The sharp-shinned hawk, of much smaller size, feeds upon the smaller birds, almost all of the commoner song birds falling prey to it. In the Fresno district, the birds which seem to suffer most from attacks by the sharp-shin are mockingbirds, intermediate sparrows, valley quail, and say phoebes (Tyler, 1913). This hawk dashes in and out among trees and shrubbery and often perches on larger limbs inside the foliage. It is most common about willow thickets and the trees along streams. A crashing sound as it strikes a bird in the foliage often betrays its presence and little bunches of feathers bear mute evidence of tragedies enacted. All three species are likely to make their appearance in the chicken yard, in fact, about ninety-five times out of a hundred it is one of these three hawks which is to blame when poultry is found to have been taken by a hawk.

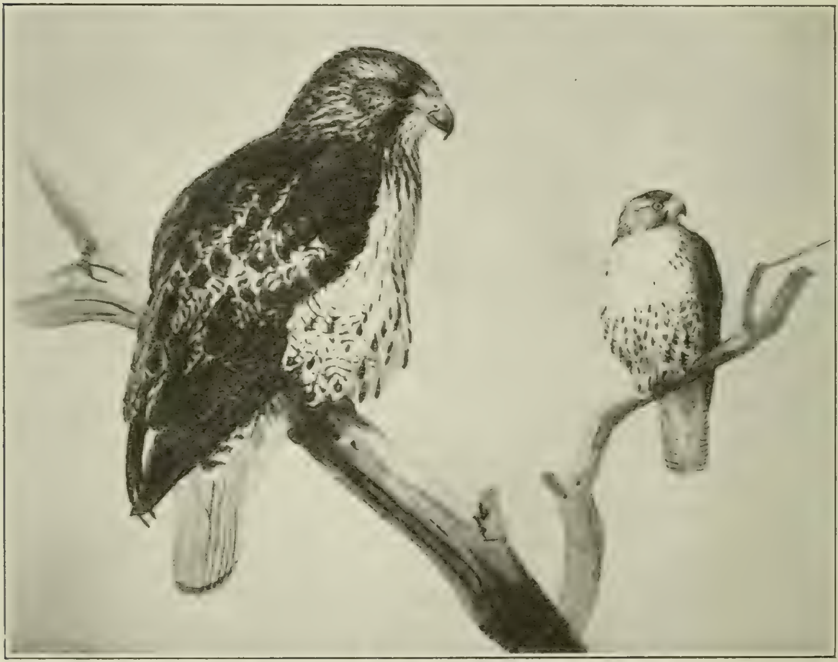


FIG. 42. Red-tailed Hawk (*Buteo borealis*). Courtesy of the United States Bureau of Biological Survey.

The duck hawk is the most powerful of the destructive species. It is a true falcon, and in Europe was considered the "noblest" of the birds used in falconry. It fearlessly attacks ducks and has even been known to attack some of the larger waterfowl. The rush of wings at it attacks its prey is said to resemble a heavy wind. Its food comprises birds, both game and nongame. Birds recorded as falling prey to the duck hawk in California are as follows: blackbirds, meadowlarks, red phalaropes, black turnstones, murrelets, auklets, ducks, doves, jays, and even sparrows. Furthermore, it is said to kill apparently for pleasure. At any rate, it often kills more birds than it eats. Stomachs of two duck hawks from southern California, each contained the remains of a mourning dove. The short tail, pointed wings, slate-colored back, and black patches on the face should help in identifying this bird; but the general actions are still more useful in recognizing it.

The prairie falcon, much like a duck hawk in appearance, lives in the rough foothill country, nesting about cliffs, and is noted as a destroyer of ground squirrels. Although a close relative to the duck hawk, it is to be numbered among the beneficial species.

BENEFICIAL HAWKS.

The two best known beneficial hawks are the red-tailed hawk (see fig. 42) and the sparrow hawk (see fig. 43). The former is the large hawk commonly misnamed "hen hawk," which is most often to be seen soaring around and around high in the air over open country, or perched conspicuously on top of a dead tree or telegraph pole. In the adult bird, the tail is reddish brown, but in the young birds the tail is barred. The common hawk call, sounding like the syllables *"pee-yare,"* which so often drives poultry to cover, is given by this bird, but it very seldom bothers birds of any kind. The red-tailed hawk is a typical rodent hawk, having large clumsy feet suitable for capturing small animals on the ground. In flight also, the bird is too slow and clumsy to be successful in capturing birds. The occasional red-tail that attacks poultry

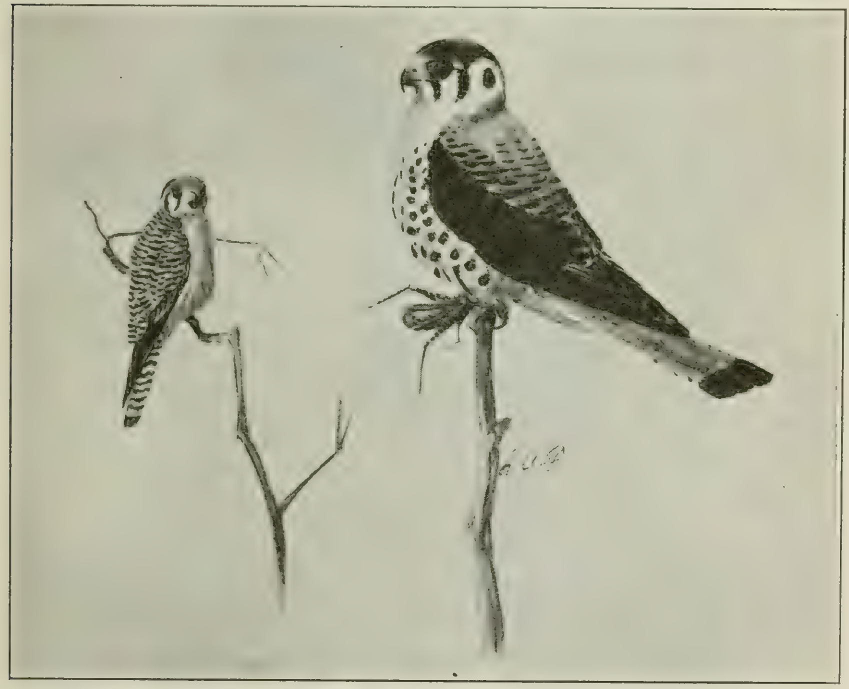


FIG. 43. Sparrow Hawk (*Falco sparverius*). Courtesy of the United States Bureau of Biological Survey.

is usually a young bird, showing that the species prefers other types of food.

The food of this hawk is made up very largely of ground squirrels and mice, to which is added a goodly supply of some of the larger insects, such as crickets and grasshoppers. The stomach of a red-tailed hawk taken in the Berkeley hills contained one meadow mouse and two pairs of jaws of the common "potato bug," or "Jerusalem cricket." One red-tail taken in Los Angeles County contained a gopher; and three others were found to have been feeding on rabbits (Bryant, 1918). Over ninety per cent of the food of this hawk is made up of noxious mammals and insects. Remains of two ground squirrels were found in the nest of a pair of red-tails in San Diego County (Dixon, 1917). In nests of the red-tail remains of gophers, ground squirrels, meadow mice, a young cottontail rabbit, and two snakes—a striped racer and a gopher snake—were found (Dixon, 1906). The red-tail preys upon snakes and may often be seen carrying a snake in its talons. Stomach analyses made by the government show over eighty-five per cent of the food to be rodents.

A near relative of the red-tailed hawk is the Swainson hawk with a white throat and dark band across the breast. This is the only California hawk which develops a flocking habit. During the migration period, Swainson hawks may be seen in flocks moving leisurely across country. This bird might well be called a grasshopper hawk for it is most often to be seen capturing grasshoppers in open fields. The birds in catching grasshoppers are said to skip about in an awkward way looking as if rather ashamed of the performance. This species also feeds on mice and gophers (Tyler, 1913). This is a fairly common hawk in our great valleys.

Another relative less often seen is the ferruginous rough-leg, so called because of the feathering on the legs, which reaches to the toes. The bird, figuratively, wears boots, and this booted appearance is helpful as an identification mark, also the white underparts, often with a dark band, and the white patch at the base of the tail on each side. The rough-leg prefers open country and is often to be seen perched on the ground near squirrel burrows. This hawk, perhaps more than any other, merits the name "squirrel hawk." Meadow mice also prove tempting as food. A rough-leg taken at Cotati, Sonoma County, contained seven meadow mice (Bryant, 1913).

The rarer red-bellied hawk is a bird of the lowlands and marshes, recognized by its reddish brown breast and its mode of flight, which reminds one of that of a horned owl. This hawk feeds on caterpillars, insects and small rodents. The stomach of one bird taken near Corona, Riverside County, contained "potato bugs" (*Stenopelmatus*) and beetles, and that of another a pocket gopher (Pierce, 1919). The stomach of a third taken in Fresno County contained large hawk moth caterpillars, beetles and "potato bugs" (*Stenopelmatus*), (Bryant, 1921). In the nest of a pair of red-bellied hawks in San Diego County, was found one ground squirrel and two pocket gophers, carried there to feed the three young birds in the nest (Dixon, 1917). In another nest was found a brush rabbit, hair of a ground squirrel and an alligator lizard (Sharp, 1906). Stomach examination has shown fence lizards (Dixon, 1906), Jerusalem crickets and caterpillars.

The golden eagle (see fig. 44), although often accused of stealing farm animals and poultry, is deserving of careful protection, for its food is made up almost wholly of the larger rodents. A nest examined by J. B. Dixon in San Diego County, contained the remains of eleven ground squirrels, largely the surplus carried to the two young birds in the nest (Dixon, 1917). Rabbits and ground squirrels are the principal items of food. The notable decrease in numbers has been due to the desire of many to kill something large, not to a desire for relief from depredations. It is particularly important that the golden eagle be left unmolested by the rancher.

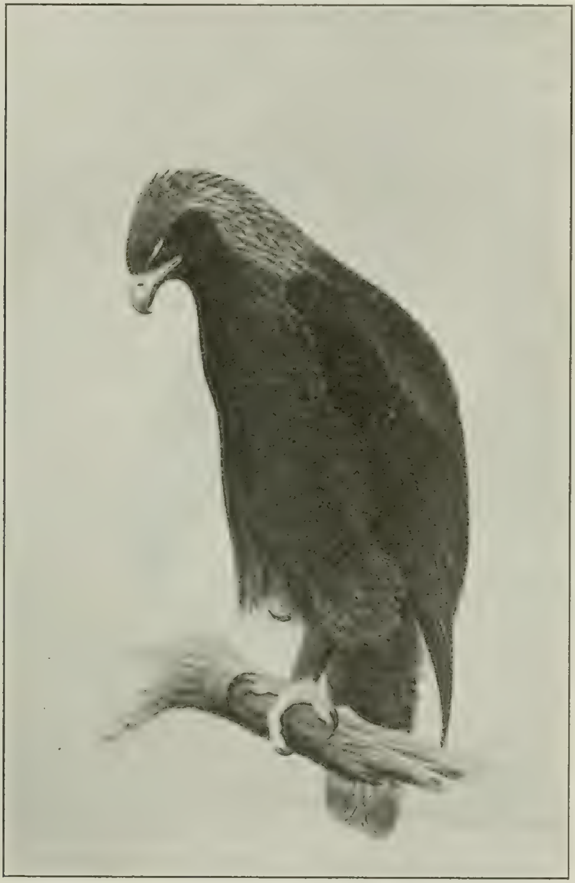


FIG. 44. Golden Eagle (*Aquila chrysaetos*). (Drawn by R Ridgway.) Courtesy of the United States Bureau of Biological Survey.

The bald eagle (see fig. 45) depends so largely upon fish as a diet that it is almost invariably found along the sea coast or about large inland lakes. An occasional fawn, lamb, or pig is taken, but this eagle is primarily a fisherman. On San Clemente Island and other islands of the

Santa Barbara group, where this eagle nests, it is said to feed on sheep and lambs, as evidenced by bones near the nest (Howell, 1917).

The sparrow hawk (see fig. 43) is the smallest and usually the most common of all and is often to be seen perched on fence posts or telegraph poles. It has a cry that sounds something like the words "*killy-killy-killy-killy*," which sometimes gives it the name of "killy" hawk. The reddish brown tail of the adult and the black bars on the face will help in the recognition of the bird, as will also its habit of poising in the air with beating wings. The sparrow hawk develops speed and captures its prey by dashing directly after it.

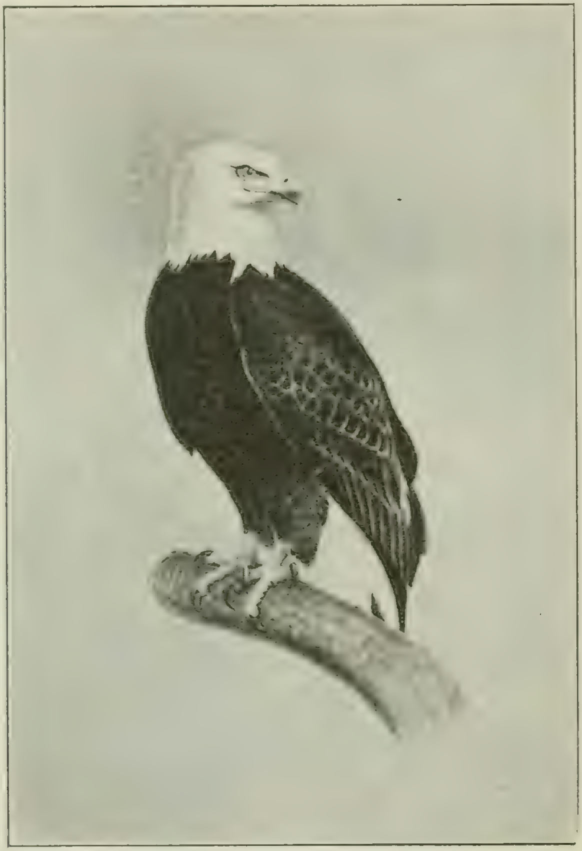


FIG. 45. Bald Eagle (*Haliaeetus leucocephalus*). (Drawn by R. Ridgway.) Courtesy of the United States Bureau of Biological Survey.

From the sharp-shinned hawk the sparrow hawk is distinguished by sharp, pointed wings which are in contrast to the short, rounded wings of the former. In the hand all of the falcons may be recognized by the notch near the tip of the bill which is lacking in other hawks. Although called "sparrow" hawk, this hawk very seldom preys upon birds, preferring large insects and mice. Grasshoppers and large beetles form the principal items of food. Tyler (1913) reports grasshoppers as the staple diet of some sparrow hawks in Fresno County.

The less common pigeon hawk is to be distinguished from the more common sparrow hawk by its darker coloration, by a blackish instead of a brown tail, and by the white throat patch. This hawk has a habit of perching humped up on conspicuous perches and when frightened flies swiftly and fairly close to the ground to another perch not far distant. The pigeon hawk does not confine itself so largely to insects as does the sparrow hawk and is guilty of preying upon small birds as well as rodents.

In lowland country the marsh hawk (see plate 2) is a familiar bird with its long wings, long narrow tail and white rump patch. It is usually to be seen flying along with leisurely strokes of the wings, about three or four feet above the ground, quartering back and forth over the meadows and marshes searching for its prey, which is comprised almost entirely of meadow mice. On the sight of a mouse the bird suddenly plunges downward and makes off with the luckless animal. The marsh hawk will occasionally help himself to a bird, or even to poultry if available. The author once saw a marsh hawk make off with a killdeer. It will be found, however, that individuals, rather than the species as a whole, are responsible for depredations of this kind. With the possible exception of the skunk, there is no animal that exerts better control on meadow mice than the marsh hawk.

Young marsh hawks are reddish brown all over, but the adult male has a whitish breast, gray back, and wings with black tips—suggestive of a gull. This is the only American hawk belonging to the *harrier* or meadow hunter group and the only hawk which nests on the ground.

The white-tailed kite, another hawk which is gull-like in appearance and which frequents the marshes, is now very rare in California and needs careful protection to save it from complete extermination. Its food habits proclaim it a beneficial hawk. The stomach of a specimen from Santa Rosa contained a meadow mouse.

The osprey, or fish hawk, is found along the sea coast and around the larger bodies of water in the interior. The white head and breast are conspicuous. This bird feeds exclusively on fish, especially such slow moving ones as carp and suckers.

The United States Department of Agriculture has pointed out that "the sooner farmers, ranchers, horticulturists, and nurserymen learn that the great majority of birds of prey are their friends, and deserve protection, the sooner will depredations of noxious rodents and insects diminish." By encouraging beneficial hawks time and effort is saved, for they automatically help control rodent and insect pests, being ever alert and ready to move to a center of infection. If given a chance, they will prove more effective than either traps or poison. Protection of hawks is the most economical pest control measure.

It must be remembered that even the so-called destructive hawks have their place in Nature, for natural enemies of birds tend to maintain within proper bounds the numbers of the species on which they prey and preserve their fitness. Many believe that the relation between the predator and the animal preyed upon is such that direct increase follows destruction of the predatory species. These same individuals maintain that on an area set aside as a refuge, increase of bird and animal life will not be noticeable unless "vermin" be destroyed. Since in the early days abundance of game was coincident with abundance of natural enemies this contention does not seem reasonable. Rather should one understand that under natural conditions there is a certain balance struck between a species and its natural enemy and oftentimes the activities of one help to balance those of the other.

Forbush (1916) who defends the above point of view gives the following example:

> "The marsh hawk (*Circus hudsonius*) feeds to some extent on marsh birds and their young, but a much larger part of its food consists of meadow mice and frogs. These mice certainly would be very destructive to young birds were they not held in check, and large frogs are known to swallow the young of water birds. Marsh hawks and other enemies prevent many frogs from reaching a size when they would be dangerous to young birds.
>
> "If nature is undisturbed, therefore, all the birds are reared and maintained that the land will support, but when civilized man steps in and disturbs the natural arrangement and balance, then, and perhaps then only, the natural enemies of birds may become unduly destructive, and must be checked."

Rodents constitute our worst farm pests. Were it not for natural checks to their increase it would be impossible to grow crops. Field mice have from four to six litters of young a year with from two to thirteen comprising each litter. It has been estimated that one pair of meadow mice are capable of producing nearly a million young in five years. Of course, such an increase is never really possible because of natural checks, including natural enemies. To eliminate natural enemies or even reduce their number disturbs the balance and increases the numbers of the pest.

Of course, artificial means of check, such as trapping and poisoning, have been devised, but their use entails time, energy, and expense. By encouraging natural checks on the increase of rodents more can be accomplished with less expenditure of effort. Most hawks eat rodents, and herein lies the reason for their encouragement.

A FIELD KEY.

Lest the good hawks be destroyed with the bad it is necessary to distinguish friend from foe. Ability to recognize the different species of hawks is, of course, the shortest road to conservation of the beneficial and destruction of the injurious. The average person finds it difficult to name a hawk seen in the open by reference to the average bird book because the distinguishing characters given are those suitable for use with a dead bird or specimen. As an aid to identification of live birds in the open the following key of field characters is appended, a key which it will be found emphasizes quite different characters from the more familiar ones found in bird books. This key has been prepared as an experiment to determine whether keys of this kind are possible, or useful. No doubt more accurate observation would be productive of

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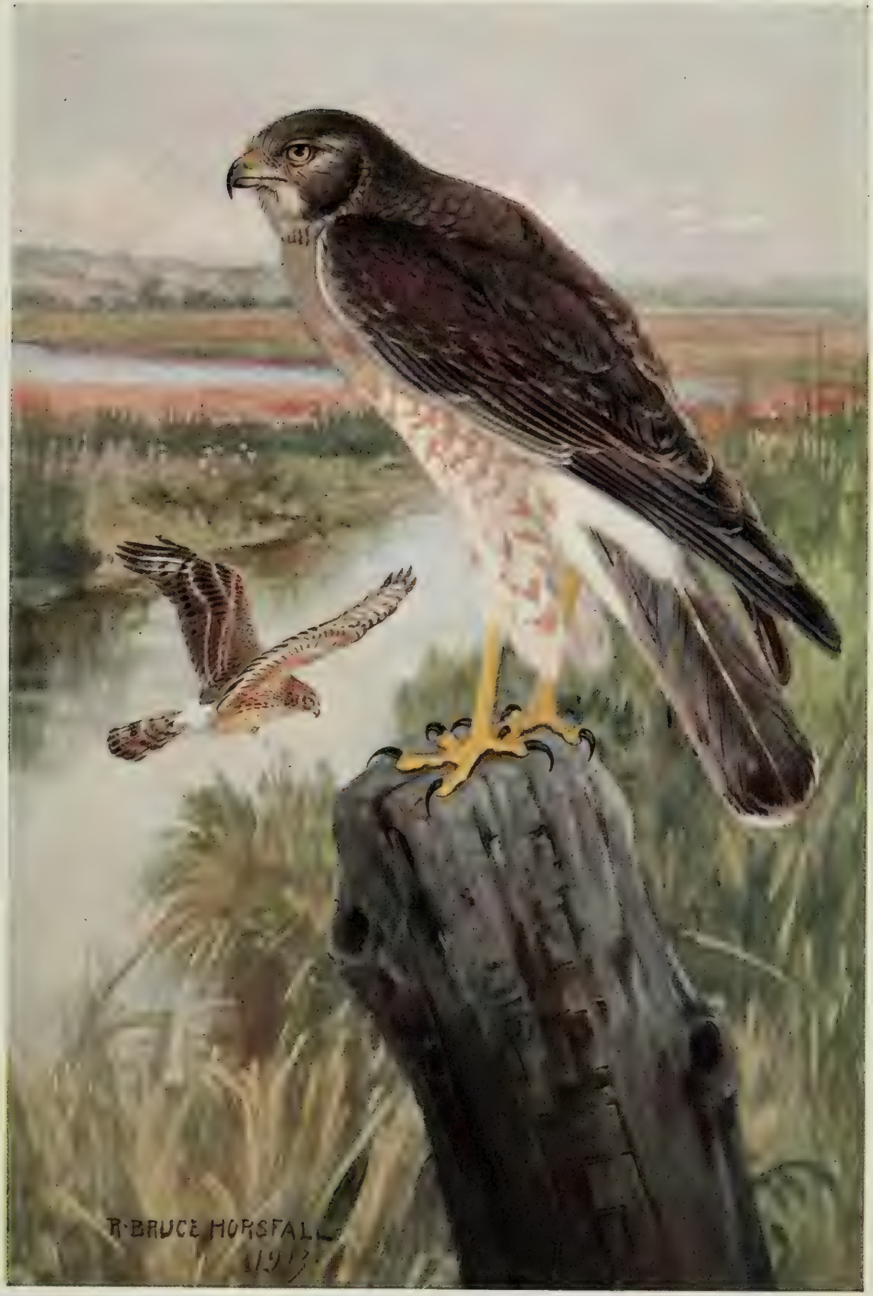
N. B. The United States Department of Agriculture has issued several bulletins dealing with the economic value of hawks, notably the authoritative work, "Hawks and Owls of the United States," by A. K. Fisher, which may often be consulted in libraries. The value of each species is judged by the results of many stomach examinations. Another review of the value of hawks is to be found in the National Geographic Magazine, Vol. 38 (Dec., 1920), under the authorship of Louis Agassiz Fuertes.



MARSH HAWK

Order—Raptores
Genus—Circus

Family—Buteonidæ
Species—Hudsonius

National Association of Audubon Societies

still better field characters and in the light of later knowledge a better key devised.

The characters which must be studied in order to use the key are: mode of flight, shape or general countour, color, color markings, and habitat. Even a better character in some cases is the call, but this has not been widely used in the key because of the difficulty of conveying an idea of the call by means of syllables. Then too, some hawks are notably silent and others are heard to call only in the breeding season.

Field Key to California Hawks.

A Soaring flight; birds of open country, or large bodies of water.

  B Body black or blackish brown in color.

    C Head not feathered and reddish in color.

      D About 30 inches in length, without white patches on underside of wings; wing tips silver gray beneath; carrion feeder--(Turkey Buzzard) TURKEY VULTURE

      DD About 50 inches in length, with snow white patches on underside of wings (under wing coverts) appearing as windows when the bird is soaring overhead; carrion feeder; very rare --(Condor) CALIFORNIA VULTURE

    CC Head feathered.

      E Head and tail of adult white in color; bare yellowish legs; call *cac, cac, cac;* chiefly near sea or large bodies of water----BALD EAGLE

      EE Head and tail of adult blackish brown; found in mountainous regions--GOLDEN EAGLE

  BB Body brownish in color; head feathered; thick set with broad rounded wings and broad spread tail.

    F Less than 30 inches in length; under 4 feet wing spread.

      G White patches on base of tail above; dark band separating white throat and belly; conspicuous black "wrist marks" under wing; legs feathered to base of toes; often perches on ground. (The American Rough-leg is a rare winter visitant which differs but slightly from the resident bird)--(Squirrel Hawk) FERRUGINOUS ROUGH-LEG

      GG No white at base of tail; legs (tarsus) strong and unfeathered.

        H Tail of adult reddish brown with whitish tip (immature birds readily confused with other Buteos); call a high pitched whistled *keee, keeee,* suggestive of the sound of escaping steam; tail spread fan-like in flight--(Hen Hawk; Buzzard Hawk) WESTERN RED-TAILED HAWK

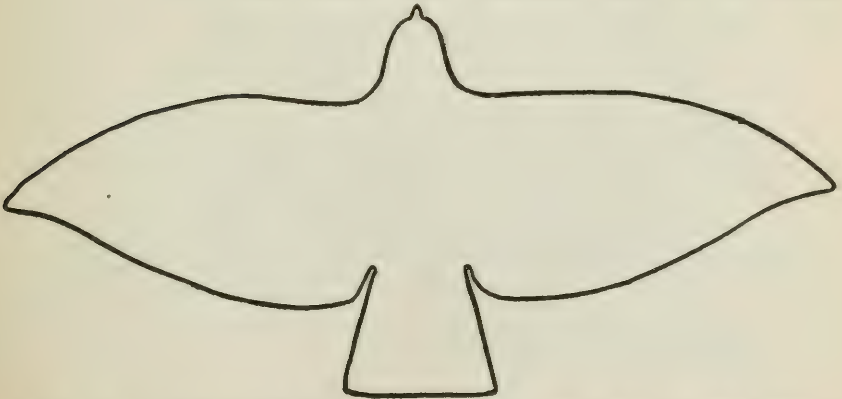


FIG. 46. Outline drawing of the red-tailed hawk, made directly from a freshly killed specimen, showing the broad type of wing usable as a recognition mark for this bird and other Buteos.

HH Tail barred with brown and breast with band of brown; forehead, chin and throat white; commonly feeds on grasshoppers; only hawk displaying flocking habit; call *pi-tick, pi-tick, pi-tick,* frequently repeated (Bailey)--------------SWAINSON HAWK

HHH Tail blackish with white bars; breast and shoulders rusty red ----------------------------------RED-BELLIED HAWK

FF More than 30 inches in length; wing spread over 6 feet; base of tail white in young; legs feathered to base of toes; call, *kiah, kiah, kiah.* (Bendire) --------------------------------------GOLDEN EAGLE

BBB Body white in color except for bluish wings and black shoulder patches; gull-like in appearance; call, a plaintive, musical whistle------------ --WHITE-TAILED KITE

BBBB Breast and head white; black eye stripe; feeds on fish--------OSPREY

AA Owl-like flight; beating wings; tail blackish, crossed by 4 or 5 white bars; breast and shoulder rusty-red; frequents willows and trees near rivers and marshes; call, *yee-ak, yee-ak,* repeated rapidly in a high key (Bendire)-- --------------------------------(River Hawk) RED-BELLIED HAWK

AAA Beating flight; harrier habits (alternate, measured flappings and sailings); long, pointed wings.

I Tail white; breast white; hovers; gull-like; rare--WHITE-TAILED KITE

II Tail not white; white rump patch, narrow tail as long as body; flies close to ground when hunting--------(Mouse Hawk) MARSH HAWK

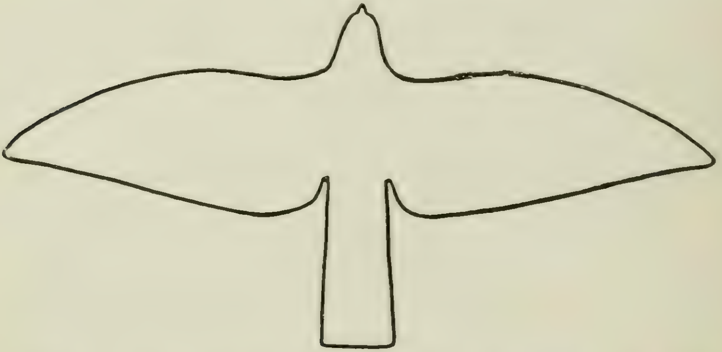


FIG. 47. Outline drawing of a marsh hawk, made from a freshly killed specimen, showing the long wings and tail which are characteristic of this hawk.

AAAA Dashing, darting pursuit flight, with alternating quick wing strokes and sailings in the open; long tail; no black markings under wings.

J Short, broad, rounded wings; barred tail; slender legs; no black bars on face; flight consisting of rapid flappings followed by a short soar; head comparatively small; seldom gives a call except when nest is disturbed.

K Length 11 to 13 inches; tail square; buoyant flight------------------ -------------------------(Bullet Hawk) SHARP-SHINNED HAWK

KK Length 15 to 19 inches; tail rounded; impetuous flight------------ ------(Blue Darter; Quail Hawk; Chicken Hawk) COOPER HAWK

KKK Length 22 to 24 inches; top of head black; conspicuous white stripe over eye; adult with barred breast and slaty blue wings------------ -------------------------------------(Grouse Hawk) GOSHAWK

JJ Long narrow, pointed wings; black bars on face forming border to whitish throat; head comparatively large.

L Without white head.

M Length 15 to 19 inches.

N Found near water; powerful flight.----(Peregrine Falcon) DUCK HAWK

NN Found in open country of interior valleys; nests in cliffs; call a high pitched *keë, keë, keë* (Bendire)----------------PRAIRIE FALCON

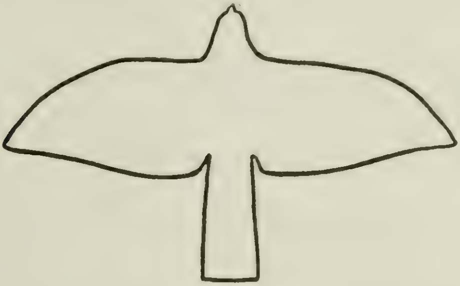


FIG. 48. Outline drawing of the sharp-shinned hawk, made directly from a freshly killed specimen, showing the short, broad wing and long tail usable as recognition marks with this and other accipitrine hawks.

MM Length 10 to 12 inches; slender build; reddish brown on back and tail; light under wings.

O Throat whitish; seldom hovers or soars; white throat patch; head large; speedy; back slaty-blue or brownish; darker in color than the sparrow hawk; rare in California------------(Merlin Hawk) PIGEON HAWK

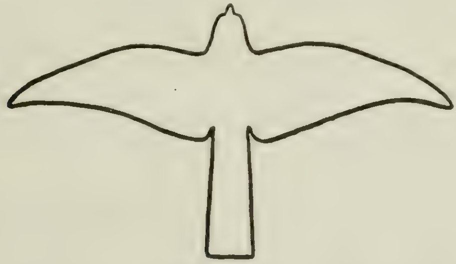


FIG. 49. Outline drawing of a sparrow hawk, made from a specimen, showing the long slender wings and long tail which may be used as recognition marks for all the falcons.

OO Throat not whitish; hovering habit; no white throat patch; wavering flight; back grayish or reddish brown; tail of male reddish brown; top of fence post, telegraph pole or tall tree usual observation station; call, *killy, killy, killy, killy*----------(Killy Hawk) SPARROW HAWK

LL White head; dark back; white breast; extremely long slender wings; black eye stripe with white above the eye; found near water; often to be seen plunging after fish; call, *ki-ik, ki-ik- ki-ik* (Dawson)--(Fish Hawk) OSPREY

A SIZE KEY.

In order to avoid the more technical terms employed in the preceding key, which lays emphasis on the mode of flight, and to make possible identification of a perched bird at fifty yards, the following more simple key is offered. A combination of both the keys will doubtless give the best results.

Size Key to Vultures and Hawks.

- Very large hawks—over 30 inches in length—wing spread over four feet.
  - Body black in color.
    - Head unfeathered like a turkey; carrion comprises food.
      - Large, 50 inches in length; white patch under wing------(Condor) CALIFORNIA VULTURE
      - Smaller, 30 inches in length; no white patch; wing tips silver grey beneath------TURKEY VULTURE
    - Head feathered, white in color; white tail (adult)------BALD EAGLE
  - Body brown in color; found in mountainous country------GOLDEN EAGLE
- Medium sized hawks—20 to 25 inches in length.
  - White on rump.
    - Distinct white rump patch; long sharp pointed wings; found in and near marshes------MARSH HAWK
    - White on each side of base of tail; broad rounded wings; legs feathered giving booted appearance; found in open country------FERRUGINOUS ROUGH-LEG
  - No white on rump.
    - Distinct black bar or bars on face.
      - Head white; found near large bodies of water------OSPREY
      - Head not white.
        - Black bluish; usually to be seen near water------DUCK HAWK
        - Black brownish; usually found in rough hilly country------PRAIRIE FALCON
  - No distinct black markings on face.
    - White stripe over eye; breast finely barred in adult; found in wooded country------GOSHAWK
  - No white stripe over eye.
    - Black shoulder patches; usually seen near marshes------WHITE-TAILED KITE
    - No black shoulder patches.
      - Tail long, barred with black.
        - Shoulder rusty red; usually seen in willows along streams------RED-BELLIED HAWK
        - Shoulder not rusty red; found in wooded and brushy country—the real "Chicken Hawk"------COOPER HAWK
      - Tail not long; fan-shaped in flight.
        - Dark band across breast; found in open country------SWAINSON HAWK
        - No dark band across breast; the commonest large hawk------RED-TAILED HAWK
- Small hawks—10 to 15 inches in length.
  - White patch on throat------PIGEON HAWK
  - No white patch on throat.
    - Tail reddish brown; dark bars on face, the commonest small hawk------SPARROW HAWK
    - Tail not reddish brown; dark bars on face indistinct, if any; found in wooded and brushy country------SHARP-SHINNED HAWK

BIBLIOGRAPHY.

Bailey, B. H.

1918. The raptorial birds of Iowa. Iowa Geological Survey, Bulletin 6, pp. 1-238; 93 figs. in text.

Bailey, F. M.

1914. Handbook of the birds of the Western United States (4th ed. revised, Houghton Mifflin Co., Boston and N. Y.), pp. 1-570; 36 pls., 2 diag.; 601 figs. in text.

Bendire, Chas.

1892. Life histories of North American birds. United States National Museum Special Bulletin No. 1, VIII, pp. 1-446; 12 pls.

Bryant, H. C.

1913. The results of some miscellaneous stomach examinations. Condor, Vol. 15, pp. 92-93.

1918. Evidence on the food of hawks and owls in California. Condor, Vol. 20, pp. 126-127.

1921. Red-bellied hawk eats caterpillars. The Condor, Vol. 23, pp. 65.

Coues, E.

1903. Key to North American birds. (5th ed. Dana Estes & Co., Boston), 2 vols., pp. 1-1152; illus.

Dawson, W. L. and Bowles, J. H.

1909. The birds of Washington. (Occidental Publishing Co., Seattle, Washington), 2 vols., XV, pp. 1-997; 44 pls., 300 figs. in text.

Dixon, Joseph.

1906. Land birds of San Onofre, California. The Condor, Vol 8, pp. 91-98.

1917. Control of the California ground squirrel. University of California Agric. Exp. Sta. Circular 181, pp. 1-16.

Fisher, A. K.

1893. The hawks and owls of the United States in their relation to agriculture. United States Dept. of Agric., Div. Orn. and Mam. Bulletin 3, pp. 1-210; 25 pls.

1907. Hawks and owls from the standpoint of the farmer. United States Dept. of Agric., Biological Survey Circular 61, pp. 1-18.

Forbush, E. H.

1916. The natural enemies of birds. Mass. Bd. of Agric. Econ. Biol. Bulletin 3, pp. 1-58; 5 pls., 5 figs. in text.

Fuertes, Louis Agassiz.

1920. American birds of prey—a review of their value. Nat. Geog. Mag., Vol. 38, pp. 460-467; 2 pls., 4 figs. in text.

Grinnell, J. and Swarth, H. S.

1913. An account of the birds and mammals of the San Joaquin area of southern California. Univ. of Calif. Publ. Zool., Vol. 10, pp. 197-406, pls. 6-10; 3 figs. in the text.

Howell, A. B.

1917. Birds of the islands off the coast of southern California. Pac. Coast Avifauna, No. 12, pp. 1-127.

Nichols, John T.

1920. Character sketches of hawks. Forest and Stream, Vol. 90, pp. 70-71.

Nicholson, G. and Pierce, W. M.

1921. Duck hawk wintering in Ontario. The Condor, Vol. 23, p. 99.

Oberholser, H. C.

1906. The North American eagles and their economic relations. U. S. D. A., Bur. Biol. Survey Bulletin 27, pp. 1-31; 2 pls., 2 figs. in the text.

Pierce, W. M.

1919. Miscellaneous stomach examinations. The Condor, Vol. 21, p. 127.

Sharp, C. S.

1906. Nesting of the red-bellied hawk. The Condor, Vol. 8, pp. 144-148; 2 figs. in the text.

Taverner, P. A.

1918. The hawks of the Canadian prairie provinces in their relation to agriculture. Canada Dept. Mines, Geol. Survey Museum Bulletin 28, pp. 1-18.

1919. Birds of eastern Canada. Canada Dept. of Mines Museum, 104, pp. 297, 50 colored pls.

Townsend, Chas. W.

1919. The identification of hawks in the field. Essex Co., Orn. Club. Bulletin 1, pp. 1-4; 3 figs. in the text.

Tyler, John G.

1913. Some birds of the Fresno district, California. Pac. Coast Avifauna, No. 9, pp. 1-114.

A ROYAL SILVER TROUT CAUGHT IN LAKE TAHOE.

By J. O. SNYDER, Stanford University.

Two skillful anglers. Dr. Ross Harbaugh and Mr. R. L. Handy, who regularly visit Lake Tahoe, report the not altogether infrequent capture of the royal silver trout, a species lately named *Salmo regalis*. That no mistake might be entertained as to their ability to distinguish the species a fine specimen was sent for determination to Stanford University where it was first described. This is the fifth specimen that has come to the hands of a naturalist, and data obtained from it is of great value in assisting to build up a description of the species. Unfortunately, it was eviscerated and nothing may be said of the sex, gillrakers, stomach caeca, etc.

The fish, caught one mile off Bijou, weighed 6½ lbs. and measured about 25 inches. It was greenish blue above, bright silvery on the sides and whitish below. There were a few very indistinct round spots on the head and on the sides below the lateral line. The fins were immaculate. This was a larger example than those originally described* and the head and fins were somewhat shorter.

The following measurements are recorded in hundredths of the length to base of dorsal fin. Length head .20, depth body .215, depth caudal peduncle .095, length snout .062, maxillary .11, diameter eye .03, interorbital width .08, depth head .14, snout to occiput .124, snout to dorsal .455, snout to ventral .54, height dorsal .11, height anal .11, length pectoral .13, length caudal .165. Number dorsal rays 11, anal 11, pectoral 14, scales lateral series 145, above lateral line 20.

There is no reason for confusing this species with any of the introduced forms as the Mackinaw trout for example, but it may be mistaken for silvery examples of the Tahoe trout *Salmo henshawi*, concerning which some remarks may not be out of place here. This is the commonly distributed trout of the greater part of Nevada and of the western slopes of the Sierra Nevada mountains, and it reaches its largest size in the Truckee basin.

This basin includes the Truckee River, Lake Tahoe and tributary streams which form its source, and Pyramid and Winnemucca lakes into which the river flows, and where its waters are finally carried off by evaporation. This basin, none of the water of which reaches the ocean, offers far greater environmental variations than is usual among much larger systems, and the trout seemingly react in a medley of colors, and assume a variety of minor characters such as are not often observed among individuals of a single species.

Many anglers distinguish trout by color and body proportions, and those that fish in the Truckee basin usually recognize several native kinds. First and most commonly known is the Tahoe trout with light olive body and an array of large black spots well scattered over almost the entire surface. Examples in the nuptial dress seen in the spring and early summer have metallic reflections shining through the body color, a broad pinkish stripe on the sides, and a scarlet patch on the cheeks and above the axil of the pectoral fin. The under surface of the lower jaw has two parallel stripes of bright red, and there is a spot of red on the tongue beneath the tip. One or more bright coin-like spots of orange may be found anywhere on the head. Then there is the silver trout of Lake Tahoe, large in size, silvery in color, with many small narrow spots on the body and fins. It is usually caught in deep water. The royal silver trout not known to some anglers, blue or greenish blue above, silvery on the sides, with very small or not evident spots, might be mistaken for the above. The Truckee trout is the resident fish of the river. It is usually smaller and more brightly colored than the Tahoe trout. Another is the redfish remarkable for the great flame-red patch on the cheek. It is a migrant from Pyramid and Winnemucca lakes, entering the lower Truckee River to spawn. Also there is the tommy, a more modestly colored and smaller fish which enters the lower course of the Truckee to spawn. Finally, the emerald trout of Pyramid Lake which is pale green above, silvery on the sides and with indistinct spots or none. This fish does not enter the river to spawn.

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*Bulletin Bureau Fisheries, Vol. XXXII, 1912.

Observation of these fish has convinced the writer that but three species are involved. There are the royal silver trout of Lake Tahoe, *S. regalis* and the emerald trout *S. smaragdus* of Pyramid Lake. These are alike in some respects, and both differ from all the others mentioned in having coarser scales, 124 to 145 series between the head and base of caudal fin. They also have fewer gillrakers and other distinctive characters. As each is confined to its particular lake there is no occasion to distinguish between them, as there is no opportunity to mistake one for the other. The others, the Truckee trout, redfish, tommy, silver and Tahoe trout, all belong to one species, *S. henshawi*. The latter has fine scales, counts of a large number indicating 153 to 163 as usual while a few have as many as 170.

Of these local varieties the redfish and tommy are perhaps the most remarkable, appearing as they do in two great waves of a nuptial migration which passes up the lower Truckee River with the rise of water due to winter rains. Formerly these trout were so abundant as to fairly fill the river at times. The redfish appear first, and as they progress from the lakes their brilliant hues become intensified in the bright desert sun until the whole body shines with iridescent yellow, vermillion and red, the cheek glowing like a coal of fire. The redfish migration wanes rapidly in March, the scouts of the tommies appearing mingled with the last straggling redfish, the more belated of which are lost among the advancing hordes of tommies. The tommy, the name taken from the Piute word tama-agaih, spring trout, is smaller, generally darker in color, and more heavily spotted than the redfish. Silvery tommies and redfish appear late in the season, possibly individuals fresh from the lake.

It will be recalled that the water of Pyramid and Winnemucca lakes is rather alkaline, not fit to drink, yet it supports great numbers of fish. We have here migrations of trout from the lake to the river, like those of steelheads from the ocean. It has often occurred to the writer that observations on the trout of this rather restricted basin might form a sound preparation for a more extended attack on the difficult problems offered by trout of much wider distribution.

THE NEW CALIFORNIA STATE FISHERIES LABORATORY*

By Will F. Thompson.

On June the thirteenth, construction began upon the new California State Fisheries Laboratory at San Pedro, the most important of our fisheries centers. It is to cost in the neighborhood of twenty-five thousand dollars, and will accommodate the present scientific staff of the Department of Commercial Fisheries. The conceptions which gave rise to its building are novel and worthy of remark at this time, for it is not generally known that this project is a distinct and noteworthy departure, a fact which Californians should know and appreciate.

The building will be located near Fish Harbor, San Pedro, within two blocks of the canneries there—with easy access to the vast store of fish which is brought into them. The site has been granted to the Commission for a long period by the city of Los Angeles, and its acquisition has been a very fortunate thing. It is at the intersection of Seaside avenue and Tuna street, hence upon the two most important traffic ways in East San Pedro. Seaside avenue will, in the course of a few years, be connected with a boulevard to Los Angeles, through Wilmington and Long Beach. Tuna street, which is but a very short one, terminates upon the water front of Fish Harbor in the center of the canneries. The new building for the San Pedro office of the Commission will be built upon the same plot of ground, of the same type of architecture and will face upon Tuna street.

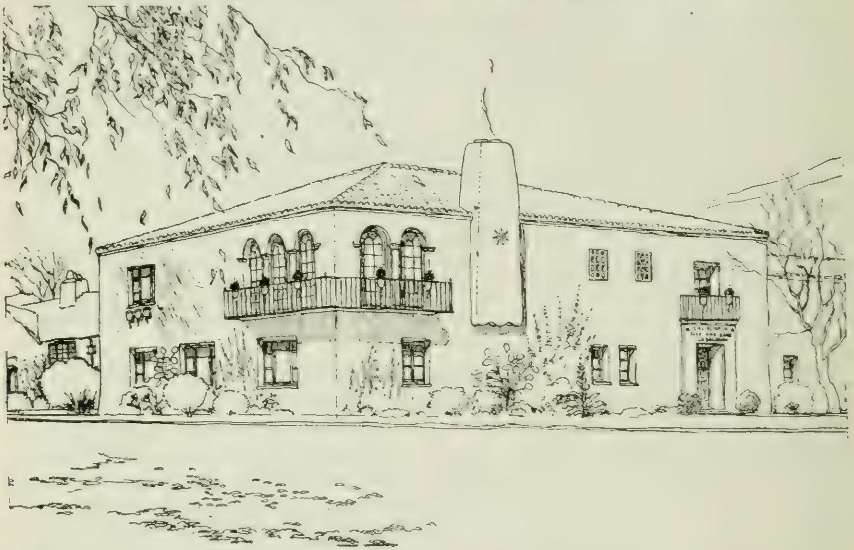

Fig. 50. Elevation of new State Fisheries Laboratory being built at San Pedro.

The laboratory building will be nearly fireproof, of reinforced concrete, with tile partitions and red tile roof. A perspective view of it is given in figure 50, and the floor plans are shown in figure 51.* There are two stories. The lower contains two laboratories capable of accommodating several workers, with windows facing nearly north and hence with splendid light for scientific work. It has also a large workroom, floored with cement and with a door through which a truck may enter. There are also a dark room for photographic work and a store room for supplies. The upper floor contains a large room to accomodate the extensive and highly technical library necessary in the work of the laboratory, as well as the files of statistical records which will accumulate. In connection with this room is a laboratory and another smaller room, the latter also destined for statistical files. A bedroom is provided for the accommodation of the student workers who may be employed.

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*California State Fisheries Laboratory Contribution No. 29.

The purpose of this building is to provide quarters for the present scientific work of the commission, the aims of which have been previously stated in CALIFORNIA FISH AND GAME, but which are well deserving of brief recapitulation in this connection since they are in a measure distinct from those of any other biological laboratory, especially of any in America. They are, in the fewest possible words, the observation of the condition of the fisheries with a view to their preservation and freest possible use. That is, true conservation.

The real abundance of fish in the sea is not obvious to whoever may look. A fishery may languish because of changing natural conditions, despite untouched abundance of fish; or, on the contrary, constantly improved apparatus may yield larger and larger returns in the face of real over-fishing. A fishery is, indeed, highly selective in its action and dependent on many things other than the real abundance of fish. So it happens that ''observers'' of the highest scientific standing casually contradict each other as to the existence of depletion and the inexhaustibility of the sea. Is it any wonder, then, that the alleged criminal ''exploitation,'' brought before legislative tribunals, pleads—as does the murderer at the bar—that his life be not taken without proof? For opinion, backed by scant evidence, is not proof, and ''exploitation'' does furnish food for the nation and is respectable, wealthy, and of good reputation generally. Opinions do have a great deal of force where, as in the case of conservation of birds and mammals, mere observation in the field is convincing to any fair-minded person, but in the case of marine fisheries this is not true.

So, in place of opinion, the real conservationists—and among these are many of the commercially interested men—must endeavor to furnish what is tantamount to legal proof. Such men as have composed the Scottish Fishery Board—men who have patiently and carefully examined into the condition of various fisheries—have proved the existence of depletion in several of these fisheries, and have demonstrated the character of data necessary, and we have profited by their experience. These data are statistics, so detailed, so extensive, and so accurately gathered that changes in gear, changes in fishing ground, and many other things may be discounted. Such data must also be examined and tested by the biologist with his criteria of over-fishing. To give such

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*By courtesy of the State Engineering Department, the floor plans modified by Mr. Higgins for purposes of reproduction.

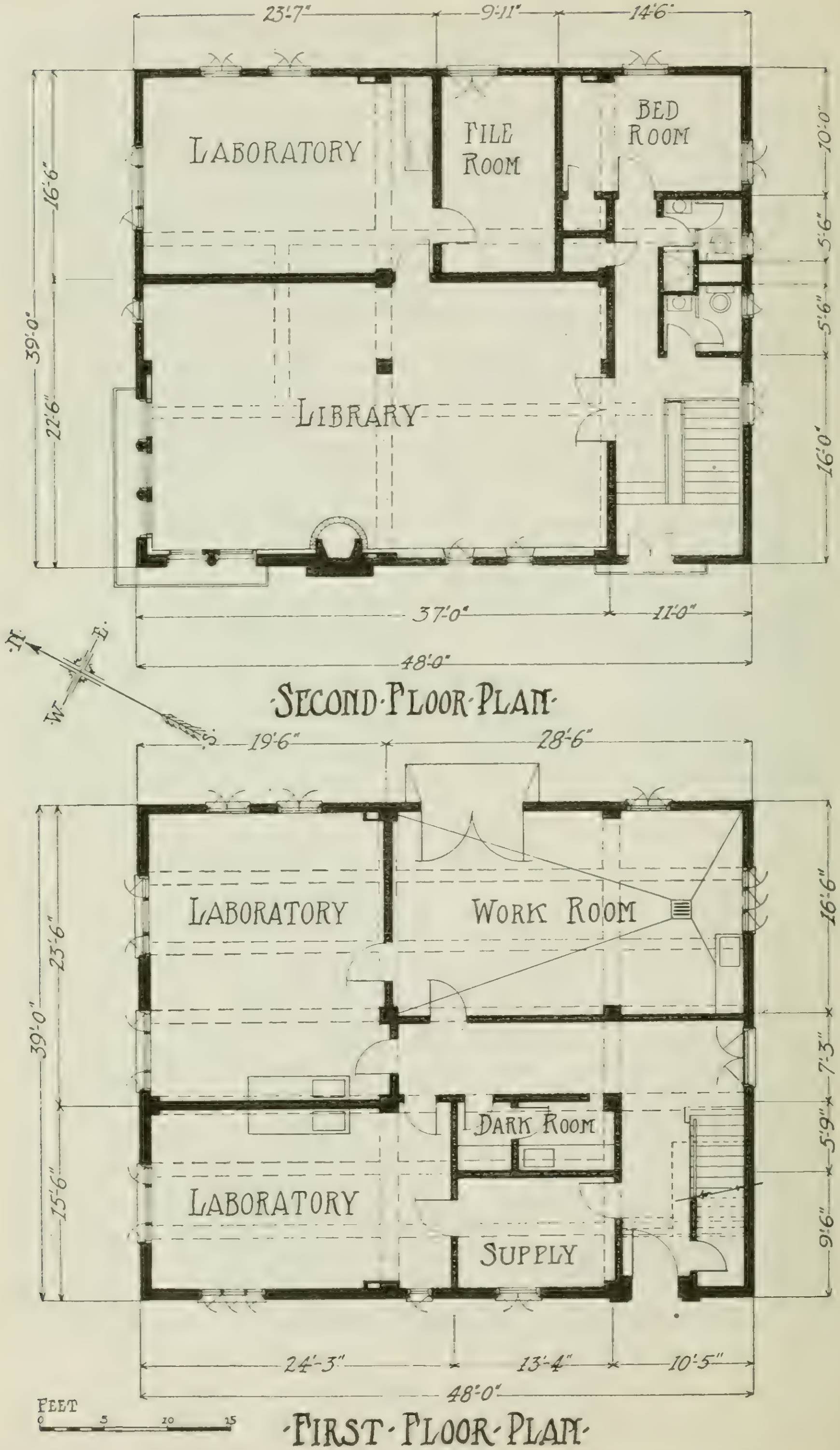

FIG. 51. Floor plan of new State Fisheries Laboratory being built at San Pedro.

proof as these data provide, is the purpose of the new laboratory. It is for the digestion and biological analysis of statistics.

Until such is done neither can exploitation proceed freely, nor may we be sure that over-fishing will not go so far as to be irremediable. There is, after all, no method for knowing how much strain a fishery will endure save by trying it, and this implies the duty of careful observation. That duty rests with the government in legal control of the fisheries and their machinery of exploitation.

The Fish and Game Commission has, in California, a system of statistics entirely suitable for such analysis. That now in use is without parallel in any country or state, to the best of our knowledge, and forms a wide and firm basis for true conservation. It is not based on estimates, volunteered information, nor inquiry, but is an actual record of the commercial transactions which take place between fisherman and dealer. This record is from carbon copies of the fisherman's receipt upon which he receives his money, and is far more probable to be correct, naturally, than any other record obtainable. It has actually provided many of the fresh-fish dealers with a record of their transactions for the first time. With all its faults—which those concerned with its administration are prone to magnify rather than ignore—so much light has been thrown upon the returns formerly obtained by inquiry and circulated questionnaire, that we regard them as of small value in comparison with what we now get.

But in addition to the high degree of accuracy, it is now possible to follow the catches of single boats from year to year, and thus to accurately compare the abundance of fish from day to day and from year to year. And it is the interpretation of the statistics from the standpoint of changes in abundance—including depletion—to which the new laboratory will be mainly devoted. The distinction between the effects of over-fishing and those of hydrographic or economic changes, and the explanation of the latter, imply the careful analysis of statistics from a mathematical and biological standpoint. It will be the function of the new laboratory to contribute toward that end, and toward the formulation of whatever knowledge exists. Such a function, it should be noticed, is based primarily upon the legal control of the state over its fisheries, and upon its power to enforce the gathering of statistics—thus assuring, we believe, the permanency of the work.

Finally, attention might be called to the fact that the vast quantity of material handled by the commercial fisheries provides an unequalled opportunity for the solution of many of the major problems of biology. We trust that the laboratory will make its contributions to those as well as to the more immediate ends.

To the proper furtherance of the aims we have outlined above, the statistical files from the state will be placed in the new laboratory, where they will be—in accordance with the law—safe from damage and accessible to investigators.

It has been realized, however, that to secure proper support for the work in hand, an exhibit open to the public will ultimately be necessary. The results obtained, the facts known about our fisheries and those of other countries, must be presented graphically and attractively. So it is planned at some time in the future to add a large, well-lit exhibit room on the southern face of the new building, between the laboratory and the new office quarters.

AN IMPORTANT DECISION ON THE FISHWAY LAW.

The Anderson Cottonwood Irrigation District is a political subdivision created under the provisions of the Irrigation Act.

The district constructed a dam across the Sacramento River above the city of Redding, Shasta County, which prevented the passing of fish up the Sacramento River. Under the provisions of section 637 of the Penal Code the district was served with a notice to construct a good and sufficient fishway over said dam.

The district refused to comply with the order and on December 20, 1920, injunction proceedings were begun against the district by Hon. Jesse W. Carter, district attorney of the county of Shasta and an application made by him for a temporary injunction restraining said district from operating said dam.

The hearing on the temporary injunction was set for January 7, 1921, before the Hon. Eugene P. McDaniel, judge of the superior court. Defendant Anderson Cottonwood Irrigation District filed a demurrer and on January 7, the matter was argued and submitted and on May 19, 1921, Judge McDaniel rendered his decision, a copy of which follows:

In the Superior Court of the State of California, in and for the County of Shasta

THE PEOPLE OF THE STATE OF CALIFORNIA, *Plaintiff*, vs. ANDERSON-COTTONWOOD IRRIGATION DISTRICT, A BODY POLITIC AND CORPORATE AND W. F. SMITH, CHARLES HAMPTON, CHARLES SPANN, W. A. BROWN AND EARNEST SCHULER, AS DIRECTORS OF SAID ANDERSON-COTTONWOOD IRRIGATION DISTRICT, *Defendants*.

The complaint in the above entitled proceeding, after the statement of necessary formal matters, alleges that the Sacramento River is frequented by a great number of salmon and is regularly stocked with salmon by the Fish and Game Commission of this state; that the upper reaches of said river above Redding are the natural spawning grounds of said salmon; that the defendants have constructed, operated and maintained across the entire width of the river at the city of Redding, a dam for the purpose of diverting the waters of the river into the main canal or ditch of the defendants; that said dam constitutes an obstruction in the river which prevents the free passage of salmon over, through, by or around said dam, and that by reason thereof, said salmon are prevented from reaching their natural spawning grounds and thus prevented from propagating, reproducing and replenishing the river with salmon, which are alleged to constitute one of the valuable natural food supplies of the people, of great monetary value; and that unless the obstruction is removed, said salmon, by reason of their inability to reach the spawning beds annually and reproduce themselves, will be shortly and ultimately exterminated, to the great and irreparable loss, damage and injury to the people of California; that the maintenance of said dam by defendants is in violation of the rights of the people and constitute a public nuisance; that defendants threaten to maintain, and unless restrained by the court, will maintain the dam to the plaintiff's irreparable injury.

Following, the complaint then prays:

1. For a permanent injunction against defendants to enjoin and restrain the maintenance of said dam across the river and from obstructing the river so as to prevent the free passage of salmon;

2. That defendants, upon an order to show cause, be enjoined *pendente lite*.

Defendants have demurred on general grounds to said complaint and have made return to the order to show cause, and support said return by a number of affidavits. Upon the hearing testimony was received from witnesses for both parties upon a stipulation that the testimony should be transcribed and considered as affidavits upon the consideration of the said application for an injunction *pendente lite*.

The defense contends: 1. That an adequate fishway has been provided in its dam;

2. That the irrigation district is a political subdivision of the state, exercising a function of the state government;

3. That the injunction, if granted, would prevent the execution of a public statute by officers of the law for the public benefit;

That the injunction cannot be granted to prevent the execution of a public statute by officers of the law for the public benefit; and that nothing which is done or maintained under the express authority of the statute can be deemed a nuisance;

4. That in this proceeding, under the facts shown by the affidavits and testimony on the part of the defendants, estoppel against the state has been established;

That the dam in question is under the authority of the Department of Engineering, and not the Fish and Game Commission.

5. That by the enactment of the California Irrigation District Act, the state has not only waived its property rights in the stream by implication, but has, by the provisions of section 56 of the act, expressly granted such rights to the district.

Some of the foregoing matters were presented in support of the defendants' demurrer to the complaint, and nearly all of them were urged in support of defendants' opposition to the issuance of a temporary restraining order.

It is not necessary for this court in a long opinion to review the many authorities cited in the exhaustive and able briefs of respective counsel. Only those authorities will be cited which are necessary to notice as support for the court's conclusion upon the issues.

The demurrer will first be disposed of. In my opinion the facts stated in the complaint are sufficient to constitute a cause of action, and when conceded to be true, as they must be on demurrer, show such an obstruction of the free use of property as to interfere with the comfortable enjoyment of life and property, not only by an entire community and neighborhood, and a considerable number of persons, but by all the people of the State of California.

People vs. *Truckee Lumber Company,* 116 Cal., 397;
Yolo Water and Power Company, a corporation, vs *Superior Court,* Vol. 30, C. A. D., 3.

The last above cited case in my opinion disposes of several of the defenses of the defendants herein, in as far as those defenses bear upon the demurrer. It holds that the superior court has jurisdiction to hear and determine a suit brought in the name of the People of the State of California, against a public utility to enjoin it from committing a public nuisance.

This case is also reported in 185 Pac. 195, and seems to be the latest expression of our courts as to the right to maintain a suit against a public utility for the abatement of a public nuisance by an injunction. It is my conclusion, therefore, that the demurrer should be, and it hereby is overruled.

The testimony produced by the respective parties in affidavit form and that orally received by the court from the witness stand was irreconcilably conflicting. That on the part of the defendant controverted or at least attempted to controvert every material averment of the complaint as to the creation of the public nuisance in question.

In view of the conclusion reached as to the issuance of a temporary restraining order, it will be unnecessary at this time for the court to decide some of the contentions, for instance the matter of estoppel *in pais* urged by the defendant. However, the opinion may be expressed that there was not sufficient evidence on the part of the defense to establish any estoppel as against the plaintiff.

The general laws of the state, particularly those of the Penal Code, furnish ample authority for providing adequate fishways over dams and artificial obstructions. The California Irrigation District Act furnishes ample authority for the building of obstructions and dams in the streams of California for the purposes of irrigation; but there is no necessary conflict, implied or otherwise, in the statutes relating to these matters, nor any adequate reason for any clash of authority between different state agencies in enforcing all the laws.

It was never the intention of the Legislature, in enacting the irrigation law, to permit irrigation districts to destroy the fishing interests of the state, nor was it its intention to permit the penal laws to operate in such a way as to prohibit the construction of necessary works needed for the development of vast irrigation projects. These laws must all be given a reasonable interpretation and so carried out and enforced as to avoid unnecessary conflict, and so that all of the varied interests of the state may be conserved. The plaintiff herein seeks not the destruction of the dam across the Sacramento River, but only desires to prevent its maintenance in such a manner as to bring about the destruction of the fish in the stream.

In my opinion, there is little merit in the argument that this proceeding is an attempt to interfere with the operation of any public statute.

The testimony for both parties on the hearing shows that the dam in question is at most not to exceed fifteen feet in height and it therefore undoubtedly is true that it is reasonably possible to construct an adequate fishway over, by or around the said dam, if the opening now existing in the middle of the dam, as a matter of fact, be an inadequate fishway or no fishway at all, which is the big question in the case.

Upon that question, as noticed before, there is so far such conflict as to require in its determination a decision upon the merits of the whole case. While it would seem that perhaps enough testimony was received by the court to enable it to resolve the conflict, I feel sure that there would be grave danger of error and injustice by its determination at this time. Witnesses for the plaintiff of reputable character in all respects testified to facts indicating that it is a practical impossibility for spawn-laden fish to pass through the twelve foot opening in defendants' dam during the running season to the spawning grounds. In opposition, equally reputable witnesses on behalf of defendants swear positively that such salmon readily pass up the river through the said opening. One witness declares he observed as many as ten salmon pass up and over the dam through the opening in five minutes.

The court is astonished there should be such a conflict on a question capable of actual demonstration. It should be easily determined by ocular investigation during the fish running season. When the matter is fully at issue, the hearing may be brought on before the court during the spring or fall run of salmon; if respective counsel and the court will arrange to have the suit heard at such a time, then in addition to hearing witnesses testify, the court, if it saw fit, could actually go to the dam and there by observation and examination, learn the real facts.

While now satisified that it is probable that there is a serious obstruction to the free run of salmon and grave danger of depletion in the number of salmon reaching the spawning grounds, with consequent injury to a renewal of the supply, the court is not now satisfied that there is danger of irreparable injury; at any rate, irreparable injury greater in estimation than might result to the defendants and to the people at this time, if the defendants should be compelled, by a mandatory injunction, to make a larger opening in the dam, as the irrigation season is almost at hand and defendants' supply of water might be cut off by the issuance of such injunction *pendente lite*.

Upon the authority of the cases cited by defendants' counsel, viz., *Gagliardo* vs. *Crippen*, 22 Cal. 362, and *Schwartz* vs. *Arata* et al., Vol. 31, C. A. D. 265, 188 Pac. 313, it clearly is a matter of discretion with the court whether to issue the injunction or not, and in view of the foregoing considerations, in my opinion, no injunction should be issued until the case is heard upon its merits.

To recapitulate: 1. It hereby is ordered that plaintiffs' motion for a temporary restraining order or injunction *pendente lite* be and it hereby is denied.

2. It hereby is ordered that defendants' demurrer to plaintiff's complaint be and it hereby is overruled, with leave to defendants to file their answer within ten days.

Dated: May 19, 1921.

(Signed) EUGENE P. MCDANIEL.
Judge Presiding.

This is a most important decision upon the law of fishways for there is no doubt that when a trial is had on the merits of the case it can be shown that the dam in question is such an obstruction to the free passage of salmon that unless a good and sufficient fishway is constructed it will completely exterminate the run of salmon on the Sacramento River, its tributaries, McCloud and Pitt, and other streams.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to **H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.**

JULY, 1921.

A HAWK NUMBER.

This number contains an article designed to interest our readers in the conservation of hawks. Beneficial hawks, because of deeds committed by a few relatives, have received much persecution at the hands of farmer and sportsman. Being large conspicuous birds and with a slow rate of increase they have suffered more than others; some species have been practically exterminated. The Condor, or California Vulture, is now one of the rarest birds in the state and the White-tailed Kite is approaching extinction. Neither can be considered injurious species. In addition to a discussion of the economic value of the various species of hawks based on California data, there is added a field key which it is hoped will be found useful by those desiring to distinguish the beneficial from the injurious hawks. An attempt has been made to use characters helpful in field identification rather than those useful with a bird in the hand.

SOME OF THE IMPORTANT CHANGES IN THE LAWS AFFECTING GAME.

A number of important changes were made in the seasons for taking game, at the 1921 session of the state legislature.

The deer season in the Sierra districts and also in Humboldt, Del Norte and Siskiyou counties will not open until September 1 and will close October 15. In southern California the season will not open until September 16 and will close October 15. In the coast districts the season will be the same as last year, opening August 1 and closing September 14.

Ducks, geese, brant, jacksnipe and mudhens may be killed from October 1 to January 15.

The most radical change was the creation of practically a blanket season on all species of quail. Heretofore, mountain quail could be taken in the Sierra districts September 1; under the new law the season will not open (except in Del Norte, Humboldt and Siskiyou) until November 1 and will close January 15. In the counties mentioned quail may be taken between October 15 and December 15. The same season for taking quail will apply to cottontail and brush rabbits, November 1 to January 15.

Sage hen may now be taken from August 1 until September 15. This will give an opportunity to take young birds before the flesh has become strong from sage. In district 4½ sage hen cannot be taken at any time of the year.

The change in the trout law delaying the opening of the season one month in the principal districts will give much better fishing within the next few years. Trout have not finished spawning by the first of April and if the supply of fish for the greatly increased number of anglers is to be kept up, breeding fish must be given every opportunity to spawn. Under the new law the season will be open from May 1 to October 31 in districts 1, 1½, 2, 3, 4 and 4½. A new district was made in the western part of Mendocino County consisting of that portion of the county draining direct into the Pacific Ocean. In this district, known as 2½, the trout season will be open from July 1 until Febraury 14. The season in the Tahoe and other smaller districts will be the same as last year.

Another important provision in the trout law is the reduction of the limit to 25 fish per day. This will be a great help in keeping California streams filled with trout. Added protection is given trout and other game fish by a new section numbered (632 a) and by an amendment to the section referring to night fishing and hunting. Section 632a prohibits the placing of any obstruction in any stream that will impede in any way fish from making their way up and down stream.

The other section provides that no game fish may be taken between one hour after sunset and one hour before sunrise.

The section prohibiting hunting in game refuges was amended so as to prevent the possession of game or fire arms in any refuge except under permit from the Fish and Game Commission.

SUMMER RESORT WORK TO BE CONTINUED.

Several years ago the Fish and Game Commission began carrying their educational campaign into the summer resorts where it was found that people were particularly susceptible to information concerning fish and game and wild life conservation. It was found also that a large number of people could easily be reached in a short length of time. Under urge from the National Park Service an intensive educational campaign was undertaken in Yosemite National Park, under the title "Nature Guide Service." Thousands were taken on trips afield gaining first hand information of wild life and over twenty-six thousand persons attended camp-fire talks and illustrated lectures given by the nature guides.

This work is to be continued in Yosemite during the summer of 1921, the Fish and Game Commission sending their educational director, Dr. H. C. Bryant, to take charge of the work. Dr. L. H. Miller, of the Southern Branch of the University of California, will share in the work and other assistants have been provided. Nature study libraries and exhibits showing the work of the Commission form a part of the program. "To read nature as one reads a book" is the motto followed. Certainly, work of this kind is of great service in building a public sentiment favorable to wild life conservation.

ARE BAG LIMITS TOO LARGE?

Consideration of present day game laws and the need for more restricted bags leads one to question the advisability of continuing to allow each hunter to have a separate bag limit on the various species of game. Why should a man be allowed twenty-five ducks, eight geese and twenty-five snipe in a single day should he be able to secure them? Or why should the law allow the upland hunter fifteen quail and fifteen doves in one day? Certainly, such bags would be far more than a man could utilize himself or advantageously give away.

The day is not far distant when bag limit laws will be effective regardless of species. Fortunately, there is a tendency among hunters to limit their kill to the number of birds they can utilize, and consequently, such a law would only curtail the game hog.

DUCK HUNTING FROM AN AIRPLANE

There has been considerable discussion and consequent investigation concerning the protection of the rice fields from the depredations of ducks. In 1919, it was decided that the most effective methods of control were to be obtained by herding and bombing, and the government solution of the problem appeared satisfactory to the growers.

Since then a good deal of publicity has been given the method of protecting rice crops by airplane duck patrol. The Standard Oil Bulletin, November, 1920, states that: "last year an aeroplane patrol was established as an experiment. It worked so well that this season it was repeated, and now five planes are kept busy, making both day and night flights to frighten off the wild ducks."

The American Game Protective Association makes the following criticism:

"We have been told that permits were granted to the rice growers of California to use aeroplanes to frighten the ducks from their growing crops. This appeared to us to be a very good idea, as efforts to frighten birds away from growing crops by gunfire has never accomplished the results desired, and is nearly always used by unscrupulous gunners as an excuse to shoot out of season. However, if aeroplanes under permits of this kind are actually killing birds, such permits should be immediately revoked:"

Last fall a motion picture was shown over the country of one of these hunts, and at the same time, pictures appeared in the Sunday news supplements which showed that many birds were slaughtered by being hit with the propeller and other parts of the machine. The projection of the motion pictures was discontinued when it was learned that this picture was causing many protests, and that investigations were being made to ascertain where the pictures were taken. The supposition seems to be that it was photographed in California, and that the airplane was operated by an army lieutenant from Cressy Field. If this proves to be the case, certainly some immediate provision should be made to protect the migrating waterfowl and to prevent a glaring violation of the Migratory Bird Treaty Act. The state law prohibits the shooting of game birds or mammals from an airplane, but does not definitely provide against ruthless slaughter by propeller and guy wires.

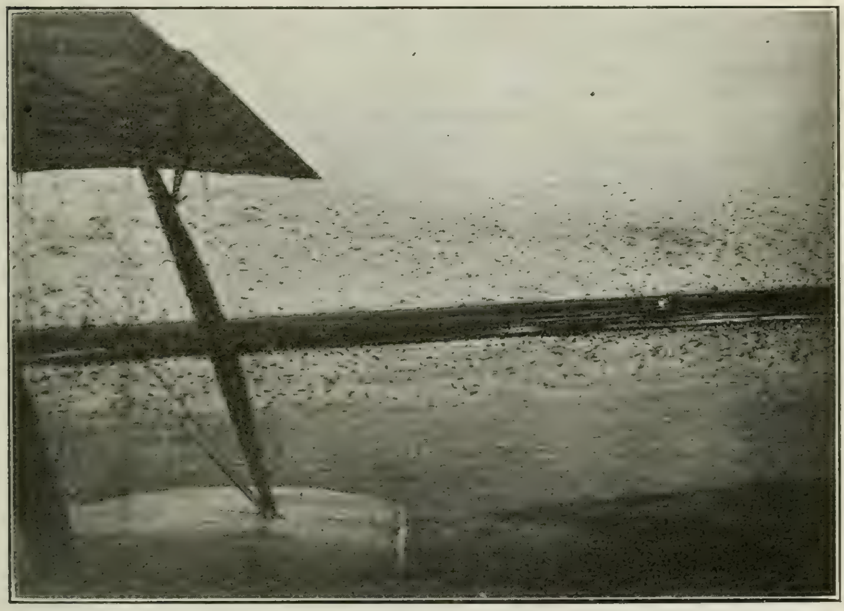

FIG. 52. Airplane routing ducks from the rice fields. Photograph by L. V. Halbrook, special Standard Oil agent at Willows, California. Courtesy of the Standard Oil Company of California.

SALMON DEPLETION IN BRITISH COLUMBIA.

During the war there was a noticeable dependence upon the results of scientific research. It is becoming more and more evident that more dependence can be placed upon conclusions of men who have scientifically investigated a problem than upon the guesses of the untrained worker. We have seen no better example of this change in attitude than in the recent reports regarding the prospective take of salmon in British Columbia during the coming season. Even the "British Columbia Financial Times," a journal of finance and commerce, has published in full the report of Dr. C. H. Gilbert, of Stanford University, who points a dark future of the salmon run in the Fraser River. He offers the ominous prediction that "big years" are wholly a thing of the past. The same article accompanied by an editorial appears in the "Canadian Fisherman," (March, 1921). On the basis of the findings of this scientist also, the American Can Company is planning to furnish only one-third of the number of cans usually supplied the canneries of this section.

Thus it can be seen that the predictions of a scientist bear more weight than those of the average fisherman who would predict, on the basis of past cycles, another splendid season for the year 1921.

In Dr. Gilbert's article, "The prospects of Fraser River sock-eye run in 1921," he states that two entirely independent lines of evidence had pointed to a greatly decreased run of salmon in 1917. One of these was the blockade of the Yale Canyon in 1913, which was just in time to intercept the spawning run of that year—due to be a "big year," for prior to 1917, a big year occurred without fail in every fourth season. In 1917, a pack of 560,000 cases was produced, little more than one-fifth the pack of the big year of the previous cycle.

It is known to all packers and fishermen that the year before the large run was always made conspicuous by the occurrence of large numbers of greatly undersized individuals—male fish—which evidently constituted a class apart from the main body of the run, and which in the small years of each cycle were rarely encountered. The packers put up these fish separately because they contained less oil and were paler in color, as an inferior grade. They were thus in a position to compare their abundance in the years of their occurrence with that of four or eight years previously. From observations made, it came to be currently believed that whenever the number of small fish was relatively large then the big year which followed would be correspondingly increased in comparison with other big years. Then it became further known that the "usual run of sock-eyes to the Fraser were maturing the fourth year of their age, while these undersized males—or grilse, as we call them—were maturing in their third year; and they would therefore make their appearance in the run one year earlier than would the four-year fish which resulted from the same spawning. If, then, the spawning of the last big year had been an unusually successful one, this might be expected to result in an exceptionally large run of grilse three years thereafter, and an equally exceptional run of the four-year fish which would constitute the big run of the following year. The number of three-year grilse in the year before the big year might well, therefore, give a clue to the probable size of the big year itself."

For this year, the same two lines of evidence are available. The data derived from the numbers of grilse, which made their appearance, and the success of the spawning fish of the three and four-year cycles, both point to a definitely worse condition for 1921.

Careful study and investigation which began in 1911 has satisfactorily determined this conclusion, and Hon. Wm. Sloan, Commissioner of Fisheries for the Province of British Columbia, is quoted as having said, "Dr. Gilbert's paper must, I think, impress the fishing interests of the state of Washington of the necessity of prompt action, and that the methods that must be adopted to reestablish the runs to the Fraser, which in former big years were so profitable to them and our own interests, will be equally successful in restoring the runs of the lean years."

CONSERVATION AND THE SCIENTIFIC COLLECTOR.

For several years past there has been a tendency in many states to restrict the scientific collector of bird specimens and eggs. In some states, the privilege of scientific collecting has been entirely prohibited. Since practically all useful information regarding wild birds and animals is a result of the acquisition of specimens, the necessity for work of this kind is evident. The curtailing of scientific collecting must result in decreased scientific information. Furthermore, there is the danger of decreasing the number of ornithologists by cutting off the opportunity for the right sort of study. Our best ornithologists owe their early interest and their development largely to the unrestricted chance for securing specimens.

We have grave doubts as to the wisdom of tightening up on those who are solely interested in birds from the scientific point of view. We cannot understand from whence comes the pressure which forces government officials or state officials to further restrict the collector. Certainly, such restriction cannot be considered an important conservation measure, as compared with other measures. Compare the effect on the species wrought by the sportsman and that by the work of the scientific collector. The sportsman is allowed twenty-five ducks in a single day and fifty per week. There are no collectors in California, even including public museums, who add twenty-five specimens of ducks to their collections in a whole year. Note also that the sportsman concentrates his attention on a few species of game birds, taking a large toll, whereas, the scientific collector obtains protected song birds largely, on which there is no concentrated hunting and where the toll is respectively very small on any one species. There are about one hundred and fifty scientific collectors in California as contrasted with more than one hundred and eighty thousand hunters. Hardly one of these collectors hunts for sport. Specimens of eggs taken do not represent, as a rule, a lessening in the annual increase of a species, for a second clutch of eggs is nearly always laid. Conservation is not hindered but advanced.

The test of legitimate collecting should be placed upon the spirit of the collector, and so long as he demonstrates that his interest is in a scientific study of wild birds and animals and that he can contribute to science, he should be encouraged rather than discouraged.

POWER PROJECT HEARING.

An important hearing on the project for the building of a large dam on the Klamath River was held at Yreka on May 12. The Federal Power Commission delegated F. H. Fowler, district engineer of the United States Forest Service, as chairman. The protestants represented were the Shasta Valley Irrigation District, Yreka Chamber of Commerce, and the Fish and Game Commission.

The certain destruction of the salmon run in the Klamath River, as a result of the proposed power project, has led the commission to oppose the undertaking. Dr. J. O. Snyder, of Stanford University, acting as a fishery expert for the commission, pointed out that two species of trout, in addition to the salmon, would be ultimately destroyed, if prevented from reaching their breeding grounds. He also pointed out that the salmon when they reach the lower part of the river are unripe and that spawning operations under such conditions would be practically impossible.

Residents along the Klamath River pointed out the value of the river as a spawning stream. The contemplated new road from the coast to Yreka will open the stream to recreationists and the destruction of the game fish in the river would have a bearing on the whole country.

TRAPPING WATERFOWL ALLOWED IN ENGLAND.

A recent conversation with a well-known sportsman naturalist who has just returned from England brought out the astonishing information that the trapping of waterfowl attracted to a locality by decoys is still allowed in Great Britain. This method of securing game birds has been frowned upon for many years in America and the average sportsman would point out the great danger to waterfowl as the result of such methods. Yet, apparently, waterfowl shooting continues to be good in Great Britain. What the compensating factors are, we do not know. We wonder whether there is as concentrated hunting and as many hunters in England as there are in America.

GOOD BLACK BASS FISHING IN LAKE COUNTY.

Few Californians realize the splendid black bass fishing to be had in Lake County. With favorable weather conditions, the finest sport can be obtained. The season, which usually begins on April 1, has been rather late this year, nevertheless, a catch of twenty-two was made during April. Sportsmen of Lake County are offering a fifty dollar prize for the largest black bass taken during the season. The two fish standing highest thus far in the contest weigh six pounds four ounces and seven pounds twelve and three-quarters ounces respectively. The fish from Clear Lake and Blue Lakes, coming from cold water, are much more palatable than those taken from the warm muddy water of our larger streams. The lakes of Lake County deserve to be the mecca for the black bass fishermen of middle and northern California.

LAKE COUNTY SPORTSMEN ORGANIZE.

Lake County sportsmen always noted for their interest in fish and game, have lately organized the Lake County Fish and Game Protective Club. They have already lined up one hundred and eighty men to attain the following objects:

> "The protection and conservation of fish and game abounding in Lake County in particular and the State of California in general; to promote and encourage clean and law-abiding sport with rod and gun, target and trap shooting, and other forms of sport which may be indulged in under the supervision of this Club and at all times, to insistently discourage any and all violations of the fish and game laws of this State, and to lend assistance wherever and whenever possible to the proper authorities in prosecuting any and all such violators."

The dues of the organization are only one dollar a year. Already traps have been installed at Lakeport, and money has been appropriated for a permanent acquarium in San Francisco to boost the black bass fishing in Lake County. Deputy J. D. Dondero has been active in forming this new club.

JUDGE CLAYTON AND THE MIGRATORY BIRD LAW.

If all Federal judges delivered charges of a similar character to that of United States District Judge Henry D. Clayton, it is believed that the people generally would be educated up to the point where they would recognize the need for such laws as the Federal Migratory Bird Treaty Act and would demand a strict observance and enforcement of it. In delivering his charge to the grand jury at the spring session of the United States court at Opelika, Alabama, on April 4, this judge devoted a portion of his address to the Federal Migratory Bird Treaty Act.

Judge Clayton spoke as follows:

> "Gentlemen of the grand jury, I call your attention to our National Migratory Bird Law. I do this for the purpose of asking you to examine into any infractions of this law, and also for the purpose of directing public attention as far as I can to this important subject, to the end that uninformed sportsmen may not violate the law and to warn those who are not sportsmen that they must not violate the law."

He emphasized also the need for those who know of the law and who realize its importance to talk on the subject at every convenient opportunity, especially, to the young people, in order that they might be better informed.

To the sportsmen he said:

> "Every man who loves the sport of shooting should send a request to the United States Department of Agriculture and ask for Bulletin 1138, which contains the game laws, state and Federal. It will cost only the postage on his letter or card."

In conclusion Judge Clayton laid particular stress on the fact that Congress and the courts aimed to uphold this law. His closing statement was as follows: "Let me emphasize the fact that it is the intention of Congress and the courts to have this law enforced."

RESOLUTION ON THE CONSERVATION OF FISHERIES.

The following resolution has been submitted to a conservation committee of the San Diego Society of Natural History:

WHEREAS, It has been repeatedly shown and is well-known that over-fishing has depleted or destroyed the fisheries of anodromons and of ground fishes in easily accessible coastal waters everywhere to the serious injury of peoples dependent upon them for food;

WHEREAS, There is evidence that the rapidly improving methods of fishing are threatening pelagic fisheries with similar depletion or destruction;

WHEREAS, These dangers to both types of fisheries are seriously increased by the use of enormous nets and other gear which injure or capture many fishes not salable or which injure and fail to capture many of those salable which escape to die because of their injuries;

WHEREAS, Due to use of such gear there is further danger to such fisheries by disturbance and breaking up of spawning beds for either themselves or fishes upon which they prey;

WHEREAS, There is frequent wilful violation of protective laws on the part of commercial fishermen, especially certain aliens who also wantonly waste and destroy great quantities of sea foods which they can not successfully market; and

WHEREAS, It cannot be expected that commercial fisheries under a system of open competition can possibly protect these marine resources from dangerous exploitation; be it

Resolved, That this organization urge upon our people the necessity of providing adequate limitation as to numbers and equipment of commercial fishermen, together with complete prohibition of net and other gear which is highly destructive or injuriously disturbing to marine conditions of life;

That we deplore the activities of destructive and irresponsible aliens for which we urge completely repressive measures;

That we hereby approve and sustain those efforts of our public officials which tend to preserve these valuable resources, and

That we urge and encourage these officials to still greater effort as opportunity may be found in that direction.

CHINOOK SALMON IN LAKE ONTARIO

The United States Bureau of Fisheries, during the fiscal year 1919, planted 434,500 Chinook fry and 149,500 Chinook fingerlings at different points in Lake Ontario, and these fish, which have now reached a length of about ten inches, have been found at the mouth of the Niagara River.

Mr. H. Otto Wagner of Youngtown, New York, who operates a fishery at the mouth of the river, states that sixteen of this species have been caught which were all about the same size. An expert in the Bureau of Fisheries identified two fish sent by Mr. Wagner to the commission on October 27, 1920, as Chinook salmon nearing the end of the second year of growth. — *The Conservationist,* March, 1921.

THE FISH AND GAME COMMISSION PATROL SERVICE.

In considering the patrolling duties of the Fish and Game Commission, we are convinced that those entrusted with this responsibility are leading a very active life.

The patrolling service consists of the water patrol and the land patrol forces.

Patrol Boats.

In 1910, the patrol boat "Quinnat," which is a cruiser, or raised deck type of boat, was built for the commission, and today the commission has six patrol boats for the enforcement of the fish and game laws of the state.

San Francisco Bay and the near outside waters are covered by the boats "Quinnat" and "Steelhead," the river fishing districts by the boats "Rainbow," "Barracuda" and "Shad." The first two are commercial fisheries patrol boats, while the other three come under the heading of general patrol, as they have considerable game as well as fisheries patrol work to do.

The "Albacore," built in 1918, is used for the patrol of southern California waters. It is sixty feet in length with a cabin and accommodations for six persons. The boat is used for patrolling and investigation work from Santa Barbara to San Diego. The average mileage for this boat for the twelve months during 1920 was 541.6 miles per month—this figure includes all time lost in lay ups, stopping for repairs, etc. And although the figures for 1918-1919 are not at hand the mileage was probably more.

Land Patrol.

Patrol by land and water are closely linked together, for in connection with the Commercial Fisheries' patrol service there are three men in the employ of the commission who work about the piers and the fishing docks. Such patrolmen are stationed at San Pedro, San Diego and San Francisco. The man at San Francisco gives this branch of the work all of his time.

Aside from the water front patrol there are the game wardens and the deputies who also work out from each district office. A number of these men have automobiles, and in the mountainous and wild trail country the distances are covered on horseback. The average number of miles covered per month by automobile by the deputies of the commission has been estimated to be 935. During the trout planting seasons, their travel is necessarily heavier than during the other seasons of the year, for the two Fish and Game Commission distribution cars must be met by the men with their trucks to handle the shipments of fish, and the distribution ars alone covered during the past two seaons 65,000 miles. Without in this instance mphasizing the other phases of the work of these men it is interesting to see how perpetually the men of the patrol force must be "on the job" in the discharge of their duties.

MUNICIPAL CAMPS INCREASE IN NATIONAL FOREST PARKS.

Free permits for eight municipal recreation camps in the national forests of California have been issued by the Forest Service of the United States Department of Agriculture. This state is taking the lead in establishing these camps, where the residents of the cities which maintain the camp may obtain a summer outing at cost.

Last year four such camps were operated in the California National Forests —two by the city of Los Angeles and one each by Sacramento and Oakland. These four represent an investment of $70,000, and nearly 5000 guests were accommodated.

This year Los Angeles will have a third camp in operation, and San Diego and Fresno and Riverside counties expect to open camps also. In addition to its camps, the Los Angeles Playground Department organizes and supervises two-week hiking outings in the Angeles Forest. Three of the eight camps are in the

Angeles, two in the Cleveland, and one each in the Sierra, Stanislaus and Eldorado National Forests. The camps are from 25 to 150 miles from the municipalities that maintain them.

Only residents or taxpayers of the municipalities that operate the camps are eligible as guests, and, because of the low cost of the outing, each camper is required to render on an average one hours' daily service as outlined by the director in charge, and must also furnish his own bedding. Guests are well housed, fed, and entertained. The following rates for a two-week outing, including transportation, were in effect last year:

National forest.	City.	Name of camp.	Mls. to cmp.	Cost.
Angeles	Los Angeles	Seeley	75	$12.75
Do	do	Radford	96	14.25
Stanislaus	Oakland	Oakland	150	18.00
Eldorado	Sacramento	Sayles Flat	90	25.00

These rates were all for adults, and the rates for children under 10 were from 50 to 60 per cent of the above. The lower rates at the Los Angeles camps are probably accounted for by the fact that these camps have been in operation for several years, while 1920 was the first season for Sacramento and Oakland. The Los Angeles camps accommodated over 3500 of the 5000 guests at the municipal camps in the national forests of the state. The business men of Sacramento are so well pleased with their municipal camp that they are raising a fund of $10,000 to be donated to the city to build permanent cabins at the camp for sleeping quarters, such as are already installed at the Los Angeles camp.—*United States Department Agriculture* Weekly News Letter.

ESTABLISH QUARANTINE ON FOXES IMPORTED FOR BREEDING.

To protect owners of fox farms, the Secretary of Agriculture has ruled that all foxes offered for importation into the United States from any part of the world, except those imported for zoological gardens or similar institutions, shall be subject to inspection by an inspector of the Bureau of Animal Industry. The foxes must also be quarantined under the supervision of the inspector of the bureau until it can be determined by inspection or examination whether they are affected with a contagious disease. If such disease is found, the animals must be returned to the country of origin or be destroyed. This regulation goes into effect June 1, 1921.

The new regulation states that permits must be procured for all foxes offered for importation into the United States as provided by Regulation 11, for the importation of cattle, sheep, goats and swine, and all foxes imported for breeding purposes must be entered through ports designated for the entry of foxes as follows: Boston, Massachusetts; New York, N. Y.; Rouses Point, N. Y.; Calais, Maine; Pembina, North Dakota; and Seattle, Washington.

They must be accompanied by an affidavit made by the owner or importer declaring clearly the purpose for which the foxes are imported, viz, whether for breeding purposes or for zoological gardens or other institutions. Feed, attendants, and quarantine will be at the expense of the owner, and each owner or his agent shall give satisfactory assurance to the inspector at the time of admission to quarantine that such provision will be made. The place of quarantine, its construction, arrangement, and equipment will be subject to the approval of the Bureau of Animal Industry.

The demand for fur and the attractive prices which it commands has interested many people who are favorably situated to breed fur-bearing animals. A number of fox farms have been established in the northern states. To encourage this work and to guide those who undertake it, the department has published Farmers' Bulletin 795, the Domesticated Silver Fox; and Yearbook Separate 693, Fur Farming as a Side Line; and Department Circular 135, Maintenance of the Fur Supply.

THE SILVER FOX RANCH AT LAKE TAHOE, CALIFORNIA.

Mr. William Lewis, of Lake Tahoe, returned from a trip east last October with six splendid specimens of registered silver black foxes to add to his ranch. These were all purchased from the Borestone Mountain Fox Ranch of Onawa, Maine, after careful inspection of the best ranches in Canada and the United States. The present investment is still further proof of Mr. Lewis's confidence in this most interesting breeding industry. His ranch is at Pomin's, in a beautiful situation on the shore of Lake Tahoe. It has been built according to the most modern methods and is today probably the most up to date ranch in the west, containing nothing but high-grade registered stock.

Mr. Lewis believes in purchasing animals only from such high type blood-lines as have actually proved their value in competition. It was for this reason that he purchased all his stock this year from the Borestone Mountain Ranch, which the recent fox shows have proved is the leading ranch of North America. Mr. Lewis reports that this ranch is on the top of a mountain in an ideal situation in the heart of the Maine woods. But the fundamental reason the Borestone foxes are today the champion prize winners over all other foxes, Canadian or American, is due to their careful breeding. Their owner, Mr. R. T. Moore, a graduate of Harvard and the University of Pennsylvania, has made a study of the breeding methods, employed in the development of our famous race horses and registered live stock and has applied them to the improvement of foxes.

That these methods have been successful has been proved at the big fox shows, held in the East, at Boston, Montreal and Muskegon, during the past two years. At the very first live fox show the Borestone foxes swept the prizes, winning as many ribbons and cups as were won by any three competitors. A pup, eight months old, Borestone Sirius, was awarded the grand championship over all the adults. Among his competitors was the brother of "Reid," a fox that subsequently won the championship of the Montreal Show in 1920, and is owned by Mr. Moore.

At the much larger show held in Boston last December, the Borestone foxes again triumphed, winning fourteen ribbons and five of the eight silver cups offered for thoroughbreds. Of the three remaining cups, one was awarded to the Borestone ranch, but was refused by the owner, as he had offered it himself, and a Borestone fox tied at 93¾ points for the other two. In addition a fox born on the Borestone ranch, "Borestone Loami," was awarded the highest score in the show, 96 points, winning two silver cups and the nternational Championship of North America. In the field against her were one hundred and fifty foxes and forty of these were of the best Canadian strains, seven of which had already won prizes at the Montreal Show. One of these defeated oxes, subsequently, won the grand championship of the Muskegon Show, where the Borestone foxes were not entered. Mr. Moore now owns the grand champions of he three big fox shows and the only two foxes, that have ever been awarded 96 points or more:

Borestone Loami 96 points, International Champion, Boston, 1920.

Borestone Reid, 96 points, Grand Champion, Montreal, 1920.

Borestone Sirius, 93 points, Grand Champion, Boston, 1919.

Nearly every fox purchased by Mr. Lewis is closely related to these famous animals, or to the other eleven prize winners, of the Borestone ranch. His "Tahoe Loami" is a daughter of the famous "Borestone Loami," his "Tahoe Otto" is a half brother of the same fox, and "Tahoe Lone Star" is a nephew of "Sirius" and also of "Borestone Rigel" 94½ points, champion pure black fox. With such stock the Tahoe ranch has a splendid foundation, and under the ideal conditions at Tahoe will no doubt make a plendid showing.

Fox breeding today is beyond the exerimental stage. It has been placed upon sure foundation by the progressive work f the American Fox Breeder's Associaion. Until this association was formed t was impossible for a novice to tell the difference between poor foxes and good ones. Many inferior animals were sold at fabulous prices by unscrupulous fox raders and promoters. This will no onger be possible, if the prospective fox breeder will take advantge of the opporunities, provided by the American Association, for him to differentiate between good and bad stock. First of all, they have established a standard of perfection, by which a fox may be judged. Second, they created an advanced registration system, by which all superior foxes, that should attain 85 points or more under the standard of perfection, could be regstered as of undoubted first quality. Third, due to Mr. Moore's enthusiastic promotion and energetic effort, despite the cold water thrown on the movement by the older breeders, the first live silver black fox show was held in Boston. It was a complete success both financially and otherwise. The Canadian government sent the chiefs of their department of conservation to it, to consider the possibilities of holding a similar show, and the Montreal show of 1920 was the result.

As a consequence of these innovations, the prospective purchaser can now be sure of getting really first quality foxes for his money. He should insist that the parents of his foxes are, not only pedigreed and registered animals, but that they are also in the advanced registered class. Better still, he should, if possible, attend one of the big fox shows and there see for himself what kind of foxes are awarded the prizes.

The American Association is really a national organization, for the members of its board of governors hale from all parts of the country. Recently Mr. Lewis has been honored by being made a governor of this association. Through him it will be possible for all fox breeders of the extreme West to keep in touch with the American Association and the latest developments in this fascinating new industry.—J. H. SANDERS, *Truckee, Calif.*

WILD FOWL NEED PROTECTION AND FEEDING GROUNDS.

Although legislative measures for the protection of wild fowl have multiplied. and have added to the restrictions on hunters, these regulations have not been sufficient to maintain these game birds in their former abundance. Regions that once were the summer homes of myriads of wild ducks have been drained and placed under cultivation, and extensive areas where the birds at one time bred are now populous farming communities. These changes, say biologists of the United States Department of Agriculture, have crowded out the former feathered residents and have served in a corresponding degree to reduce their numbers. Realization of these facts has led recently to the adoption of other measures to encourage waterfowl. A number of extensive marsh areas have been made permanent refuges under the guardianship of the Department of Agriculture, and many private preserves, some formed by artificial means, have been established where the birds are protected while nesting. In addition, in a number of cases, rigid local restrictions have been placed upon hunters.

As a means of cooperating in such efforts to maintain and increase the numbers of waterfowl, the Biological Survey of the United States Department of Agriculture has undertaken investigations of the general conditions under which wild ducks live and thrive, coupled with counts of the birds found in areas varying in character. During three summers, field studies were made dealing with wild ducks in the Bear River marshes in Utah, a report of which has just been published by the department in Department Bulletin 936, Wild Ducks and Duck Foods of the Bear River Marshes, Utah.

During the three seasons devoted to this work, twelve species of ducks and the Canada goose were found breeding in the region included in the Bear River marshes, which covers an extensive area at the northern end of Great Salt Lake. In an enumeration made during May and June, 1916, of the eleven species of breeding ducks, 3,650 pairs were counted, and it is believed that this number represents between 60 and 100 per cent of the total number of breeding ducks occurring there that season. Allowing five young reared to maturity as the average for each pair, and considering 1916 as an average season, the bulletin states that, at a conservative estimate, between 25,000 and 30,000 wild ducks, native to the marsh, are to be found there at the close of the breeding season.

It was found that, in addition to the large number of birds reared on the Bear River area, many other ducks came in after the nesting season to remain there until fall. That birds from the Bear River section range widely after leaving these marshes has been shown by records of ducks that have been banded and released there and subsequently were shot elsewhere. Records thus obtained show that birds released near the mouth of Bear River in migration cover the region from Oklahoma to Texas and west to California. The department urges the establishment of a greater number of preserves where wild fowl may breed and rest unmolested, and find an ample supply of food.—*United States Department of Agriculture.*

BIRD BANDING.

The first American to become interested in the banding of birds was the great nineteenth century naturalist, Audubon. Curious to know what became of the birds that flew south with the approach of cold weather, he put threads about the legs of a brood of phoebes that he had been watching and in the following spring was rewarded by having two of the birds return to nest near the haunts where they had learned to fly. Bird banding is not confined to the banding of non-game birds alone. In the United States Department of Agriculture Weekly News Letter, of June 1, 1921, there is the following interesting article on the banding of ducks:

> When a wild duck decides to move from his summer home in Canadian wilds he neglects to leave a forwarding address to indicate where his winter quarters are to be established. The Bureau of Biological Survey, United States Department of Agriculture, is working on a method to offset the duck's carelessness. This consists of a system of trapping the birds and marking them with aluminum leg bands that carry a number and the legend "Biol Surv., Wash., D. C." When a banded duck is killed, the hunter removes the band and returns it to the Biological Survey with information showing when and where the bird was recovered.
>
> During the past autumn a Canadian collaborator of the Survey, Mr. H. S. Osler, operated a duck trap at Lake Scugog, Ontario, where he captured and banded over 200 black ducks and mallards, with a few ring-necked ducks and blue-winged teals. Some of these were killed near the place where they were banded, but others were from such localities as to indicate approximately the route taken by these birds in their journey to the Southland. In all, about 25 of Mr. Osler's ducks have been killed and the bands returned from points in Ohio, Indiana, Kentucky, Tennessee, Arkansas, Mississippi, Louisiana, and Texas. One of the blue-winged teals was killed near Port of Spain, Trinidad, British West Indies, more than 2,500 miles from Lake Scugog, where the band was attached.
>
> The systematic banding of birds, as undertaken by the Biological Survey, will furnish conservationists with much valuable information.

FACTS OF CURRENT INTEREST.

Deputies Clark and Burke arrested six Japanese near Pigeon Point, San Mateo County, for having 150 undersized abalones in their possession. These men were notified to appear before Judge Ray Griffin, which they did, and were fined $100 apiece.

* * *

Mr. Jay Bruce, state lion hunter, succeeded in killing nine mountain lions during the first three months of the year, as well as three bobcats.

* * *

Deputy Von Arks made cases last year within a five-mile radius of his home, in Sonoma County, which brought in fines aggregating thirteen hundred dollars. Deputy Von Arks evidently believes in cleaning up his home town first.

* * *

During February and March there was a round up of violators of the fishing laws in district twelve. Sixteen men were arrested of whom six were convicted, the fines totaling $695. Four nets totaling 667 fathoms were confiscated. Two of them were sold and netted $145. During March deputies O'Connell and Newsome confiscated seven nets, totaling 2295 feet, which were being illegally used in a closed district.

* * *

Deputies Groves, Lencioni, and Von Arks, working the coast between Russian Gulch and Wallalla at low tide, arrested sixteen violators for having in possession undersized abalones. The offenders were taken before Judge Charles of Sea View and the fines will aggregate over seven hundred dollars. The largest fine was one hundred and twenty-five dollars, which was awarded a market fisherman. The small sized abalones confiscated totaled several hundred.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

As the egg-collecting operations at the various hatcheries have not been entirely completed yet, we are, consequently, unable to definitely submit the number of trout fry which will be available for distribution from the various stations during the coming season. We anticipate that the output from all of the hatcheries of the state for the year 1921 will be approximately 25,000,000 trout fry. If the number of trout fry actually distributed even approximates this figure, it will be the largest distribution of fry ever made in one season in the state.

Due to adverse climatic conditions in some sections of the state, we did not take as many eggs at the spawning stations as we had anticipated; but this partial failure is, in a great measure, offset by favorable situations obtaining in other districts.

MOUNT SHASTA HATCHERY.

From present indications, we will have for distribution from Mount Shasta Hatchery this season, approximately 11,000,000 trout fry consisting of rainbow, Loch Leven, German brown, eastern brook, steelhead, and possibly a small number of black-spotted trout fry.

The Loch Leven and German brown and practically all of the eastern brook trout eggs were taken from the adult fish kept as a breeding stock in the Mount Shasta Hatchery ponds. The rainbow eggs were received from the several rainbow egg-collecting stations located on tributaries of the Klamath River, Siskiyou County.

In addition to the rainbow eggs hatched at the Mount Shasta Hatchery, a sufficient supply of eggs of this specie were received to permit of shipments being made to Mount Whitney, Ft. Seward, Kaweah and Wawona hatcheries. The supply of steelhead trout eggs which is being hatched for distribution from the Mount Shasta Hatchery was received from the Brookdale and Ukiah hatcheries.

The two fish distributing cars are in the shops of the Southern Pacific Co., at Sacramento, being overhauled and placed in first-class condition for the season's operations. The work on the two cars is practically completed and at least one car will be ready for commencing the season's perations on or about June 1.

Distribution operations from the Mount hasta Hatchery will be commenced nearly a month earlier than is usually the case. t was essential that we commence this work earlier than in former years owing o the greater number of trout fry which we will have to distribute from that staion this year.

As mentioned in a previous issue of CALIFORNIA FISH AND GAME, there were hatched at the Mount Shasta Hatchery his season nearly 6,000,000 chinook salmon eggs, which were received from the Federal Bureau of Fisheries' station at Mill Creek and from our own salmon egg-collecting station at Klamathon, on the Klamath River. As soon as the oldest of the salmon fry were of suitable age for planting, they were distributed in the head waters of the Sacramento River and the balance of 3,000,000 were removed from the hatching troughs and placed in the three large salmon rearing lakes on the Mount Shasta Hatchery grounds. These fry will be fed and held over the ummer and released in the head waters f the Sacramento River during the fall months.

FALL CREEK HATCHERY.

Rainbow egg collecting operations at the Fall Creek Hatchery were very successful, there being nearly 1,000,000 eggs of this specie collected. Approximately 600,000 of the eggs have been hatched and will be held throughout the summer months and distributed in the Klamath River at the proper season. The balance of the eggs were shipped to the Mount Shasta Hatchery to be hatched and reared for distribution in other localities of the state.

In addition to the rainbow trout hatched at Fall Creek station, 3,000,000 of the salmon eggs collected at Klamathon Hatchery last fall were hatched and are being reared for distribution in the Klamath River. A portion of the fry will be planted during the late spring months and the balance will be held in ponds constructed for the purpose last summer, and one additional pond which is now in course of construction. These fish will be held and fed throughout the summer and distributed in the Klamath River next fall.

BOGUS CREEK STATION.

Bogus and Camp Creek egg-collecting stations have been closed after completing the most successful season since the stations have been established. Over 6,000,000 rainbow trout eggs were collected from these two stations during the season which has just closed. All of the eggs collected were shipped immediately to the Mount Shasta Hatchery for incubation. During the summer some minor repairs and improvements will be made at these plants in order that they may be in readiness for operations next season.

HORNBROOK STATION.

The Hornbrook station was operated during the past season, but the number of eggs collected was far below the normal take, less than 200,000 eggs being taken during the entire season. This was due to the fact that the flood waters of the early part of the spawning season changed the course of Cottonwood Creek, forming a sandbar between the old mouth of the stream and the new cut, which prevented the trout from entering the stream to spawn. Prior to the cutting of the new channel, the flood waters were entirely over the top of the racks, thus permitting the first part of the run of spawning fish to pass on up the stream. The small number of eggs taken were received from the few stragglers which came up the creek through the old channel.

Before the station can be successfully operated, it will be necessary that considerable work be done in opening up an adequate channel to permit the fish to ascend the stream at the mouth of the creek.

MOUNT WHITNEY HATCHERY.

During the early part of December, 300,000 Loch Leven trout eggs were shipped to Mount Whitney from Mount Shasta Hatchery and during the first part of April, 500,000 rainbow trout eggs were shipped from the same station. Shipments of steelhead trout eggs to the number of 800,000 were made to the Mount Whitney Hatchery from Brookdale Hatchery. The fry resulting from these three hipments of eggs are developing into fine, healthy fish, and will be ready for distribution early in the summer.

Further shipments of rainbow trout eggs will be made from one of the other tations and we are also contemplating opening up the Rae Lakes rainbow egg-collecting station. All eggs received from his source will be immediately transported o the Mount Whitney Hatchery, where they will be hatched and reared.

LAKE TAHOE HATCHERY.

The new Lake Tahoe Hatchery, which was completed last fall, was opened for operations on May 14. A shipment of black-spotted trout eggs was taken to the hatchery on that day from the new egg-ollecting station established on Blackwood Creek. Other shipments of black-potted eggs will be forwarded as the eggs are taken at Blackwood Creek. Shipments of steelhead trout eggs from the Brookdale and Ukiah hatcheries have been shipped to the Lake Tahoe Hatchery, and within the next two or three weeks ainbow eggs will be shipped in from one of the rainbow egg-collecting stations.

MOUNT TALLAC HATCHERY.

Mount Tallac Hatchery was opened for operations during March. As in former ears, seining operations were conducted at the mouth of Taylor Creek, for the pawning trout from which are obtained the black-spotted trout eggs.

In addition to the egg-collecting operations conducted off the mouth of Taylor Creek, an egg-collecting station was es-ablished on the upper Truckee River. The stream was racked, and a trap, tank, etc., were installed. The results obtained from the operations to date have been very atisfactory.

As above mentioned, a station was put n operation at Blackwood Creek and the ggs received from this plant are incubated t the Mount Tallac Hatchery and the new Lake Tahoe Hatchery. One million black-spotted trout eggs have been taken to date.

FORT SEWARD HATCHERY.

The 500,000 chinook salmon shipped to Fort Seward from the Mount Shasta

Hatchery during February were hatched and the resulting fry distributed in Mad River, tributaries of Humboldt Bay, Eel River and other waters of Humboldt County. This was done during the month of April. Two hundred and fifty thousand rainbow trout eggs were shipped to Fort Seward from Mount Shasta Hatchery on May 16, and the resulting fry appear to be strong, vigorous fish. Over 800,000 steelhead eggs were shipped in from Ukiah Hatchery and these, together with the rainbow fry, will be given a wide distribution in the waters of Humboldt, Mendocino and Trinity counties during the coming summer.

SNOW MOUNTAIN STATION.

Steelhead egg-collecting operations at the Snow Mountain egg-collecting station did not prove to be as satisfactory as was anticipated. While there was a fair rainfall in that section this season and other climatic conditions were favorable, the usual number of steelhead spawn fish did not reach our station. Consequently, we were unable to take the usual large number of eggs. Approximately 2,000,000 eggs were taken as a result of the entire season's operations. We had expected to receive not less than 4,000,000 and possibly 5,000,000 or 6,000,000. A thorough investigation as to the reason for the failure of the spawning fish to ascend the stream to the Cape Horn dam, where our station is located, resulted in our finding that the stream had been blocked by fences, cleverly arranged in the Eel River, some distance below our stations. These had been constructed by persons who wished to prevent the fish from ascending the stream, in order that they might catch them. Those responsible for this outrage should be prosecuted to the full extent of the law, particularly since the legislature has just passed an act making it unlawful to bar the passage of fish by any weir, fence or obstruction.

The eggs taken at Snow Mountain station, with the exception of about 200,000, which were hatched for distribution in the upper waters of the Eel River, were immediately transported to Ukiah Hatchery.

UKIAH HATCHERY.

The Ukiah Hatchery was opened for operations on March 19. A total of 1,850,000 eggs were received from the Snow Mountain station. These were yed and shipments made to the Fort Seward, Mount Shasta and Lake Tahoe hatcheries. Between 500,000 and 600,000 teelhead eggs will be hatched at Ukiah Hatchery for distribution in the streams f Mendocino and Sonoma counties.

SCOTT CREEK STATION.

Egg-collecting operations at Scott Creek tation have been the most satisfactory ince the station was established. Three million steelhead trout eggs have been collected and operations have not as yet been ompleted. There will probably be something over 100,000 eggs yet taken. All eggs were transported to the Brookdale Hatchery as soon as the fish were spawned.

BROOKDALE HATCHERY.

As stated above, the Scott Creek station produced well over 3,000,000 steelhead trout eggs, all of which were transported to Brookdale Hatchery where they have been eyed and shipments of eggs made to the Mount Shasta, Mount Whitney, Lake Tahoe, Wawona and Kaweah hatcheries. In addition to eggs shipped out to the above named stations from the Brookdale Hatchery, approximately 900,000 steelhead fry will be reared for distribution in Santa Cruz, Santa Clara and San Mateo counties. Arrangements are being made for the shipments to these three counties.

DOMINGO SPRINGS HATCHERY.

Domingo Springs Hatchery was opened or operations during the middle of March nd preparations were made for trapping the run of rainbow trout ascending Rice Creek to spawn. Severe storms in hat section made it very difficult for the men to get into the station. They were obliged to go in over fourteen feet of snow n some places.

The heavy snow did considerable damage to the racks and traps at Domingo Springs Hatchery, and also to the fishculture equipment installed at the mouth of Warner Creek last fall. It is our intention to operate at Warner Creek this season, in conjunction with the Domingo Springs Hatchery, where all eggs secured rom the former plant will be incubated. At this date no eggs have been taken at

Domingo Springs or Warner Creek as the "run" of spawning fish from Lake Almanor is very late, but we anticipate a very successful take of eggs.

CLEAR CREEK HATCHERY.

The Clear Creek Hatchery was opened for operations during the middle of March, as were the Domingo Springs and Warner Creek stations. Egg-collecting operations are somewhat earlier at Clear Creek than at Domingo Springs and to date we have secured approximately 1,500,000 eggs. A portion of the eggs secured from the Clear Creek and Domingo Springs hatcheries will be hatched at these two stations to supply local streams with trout fry, and the available balance will be shipped to the new Feather River experimental station.

FEATHER RIVER EXPERIMENTAL STATION.

As mentioned in a previous report, we are establishing an experimental hatchery on Jamison Creek, a tributary of Feather River. The station is located between Blairsden and Johnsville, in Plumas County. The purpose of establishing a station at this point is to eliminate, to a great extent, the necessity of transporting trout fry from the Mount Shasta Hatchery to stock the waters in this district, as well as the district along the Yuba River, in the vicinity of Sierra City.

Eggs will be shipped to this hatchery from the Domingo Springs and Clear Creek stations. The first shipment of 200,000 eggs was delivered from Clear Creek Hatchery on May 16. On May 14, a shipment of 100,000 steelhead trout eggs was received from the Ukiah Hatchery. The eggs appear to be in first class condition. As soon as the eggs commence to hatch, we will be better able to determine what the outcome of the experiment will be.

If there is no loss of fry or eggs, additional eggs will be shipped to the station and this large territory will be supplied with trout fry from the experimental hatchery during the coming season.

NORTH CREEK HATCHERY.

Egg-collecting operations at North Creek station have been very successful. Eggs have been collected from the large rainbow trout ascending North Creek, Metcalf Creek, and Grout Creek from Bear Lake, and while operations at present are not complete, we expect to take 2,500,000 rainbow trout eggs this season. One million five hundred thousand eggs will be transferred from the North Creek Hatchery to the Bear Lake Hatchery, at Green Spot Springs, from which station the resulting fry will be distributed during the coming summer in Big Bear Lake and various streams of San Bernardino County. The North Creek Hatchery will also be operated to full capacity. The fry reared at this plant will be distributed in Big Bear Lake also. We also expect to have a couple of small shipments of eggs to send to the Mount Whitney Hatchery where they will be hatched for distribution in other waters of southern California.

WAWONA HATCHERY.

Three hundred thousand rainbow eggs, and 100,000 steelhead trout eggs from Brookdale Hatchery, have been shipped to Wawona from the Mount Shasta Hatchery and the resulting fry will be distributed in Merced River and other streams of that section during the coming summer.

Previous to opening the Wawona Hatchery for operations on April 23, certain necessary repairs were made to the flume and water distributing system at the hatchery. All the repairs could not be finished this spring, consequently, we will have to complete the work after the fry have been distributed during the summer.

KAWEAH HATCHERY.

Owing to the fact that we were unable to proceed with the construction of the permanent hatchery on the Kaweah River, it was necessary that we again operate the small experimental station established three years ago near the town of Hammond. Three hundred thousand rainbow and 100,000 steelhead trout eggs were shipped to Kaweah Hatchery and the resulting fry will be distributed in the waters of Tulare County, as has been our practice during previous seasons.

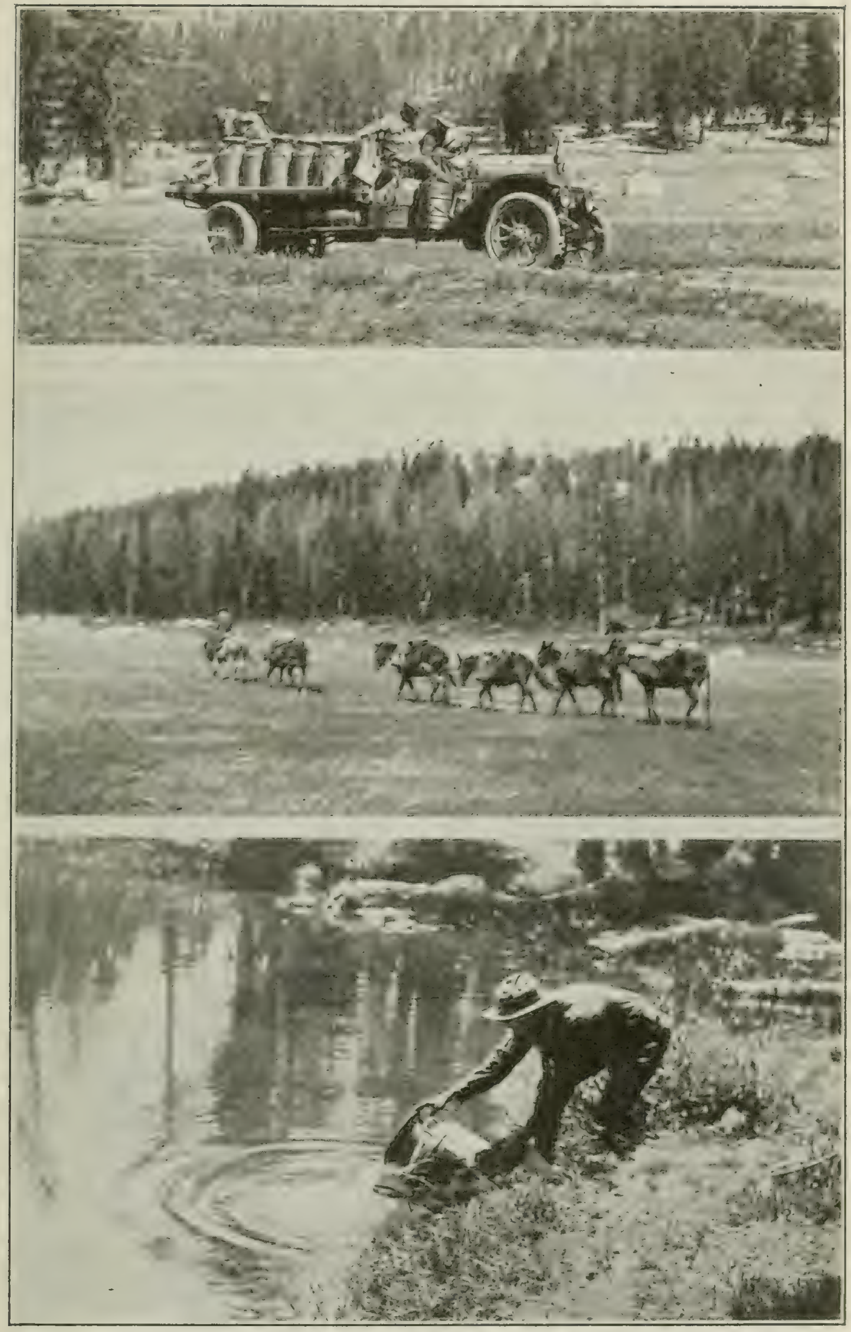

FIG. 53. Planting trout in Yosemite National Park; necessitating transportation by rail, motor truck and pack train. Photographs by H. C. Bryant.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

NEW COMMERCIAL FISHERIES LEGISLATION.

The past session of the State Legislature was remarkable in that there were fewer fish and game bills for the Fish and Game Committees to consider than for many sessions. Most of the bills introduced proposed only minor changes in already existing laws. The opinion is quite general that the present game and fisheries laws are fair and in the interest of conservation. There is also a stronger inclination for the legislators to seek and accept the advice of those of the Fish and Game Commission who have made a study of the fish and game conservation problems.

The few bills affecting the commercial fisheries which finally were passed were all good bills and received the signature of the Governor. These bills become laws on July 29, 1921. The following is a brief summary of the fisheries bills which were signed by the Governor, taken up in the order of their introduction:

Senate Bill No. 265. By Senator Rigdon.

Abalones and Clams.

Amends the present law, section 628*f* of the Penal Code.

Reduces the daily bag limit on Pismo clams from 36 to 15, but permits shipment and sale. Changes the abalone seasons by making a uniform closed season for all species of abalones from January 15 to March 15. Raises the minimum size limit on red abalones, which may be taken for commercial purposes to eight inches in greatest diameter. Restricts the commercial taking of abalones in districts 10 and 18 to the territory lying outside of a line twenty-five feet beyond low tide mark. The minimum size limit on red abalones which are taken from the shore to twenty-five feet beyond low tide mark, remains at seven inches in greatest diameter, but the number of any species of abalones which may be taken from this inshore area must not exceed ten per day and they must not be sold.

It is expected that this law will greatly reduce the commercial taking of Pismo clams and give visitors to the beaches where these clams are found an opportunity to gather enough for their own use. t is hoped and expected that the changes in the abalone law will permit the full utilization of this valuable food resource nd provide enough abalones for those who prefer to gather their own from the shore.

Senate Bill No. 576. By Senator Rominger.

Fish Reduction.

This bill amends section 5 of the act egulating the use of fish in reduction plants, etc. The present act, which was passed two years ago, intended to give the Fish and Game Commission full power to regulate the use of fish in reduction plants, but in a recent friendly suit in Los Angeles to determine if it did give the power intended, it was the opinion of the court that it did not. Therefore, section 5 was amended and enlarged so as to prohibit direct fishing for edible fish or reduction purposes and to prohibit taking any fish in excess of what can be onverted into human food except by special application to and permission from he Fish and Game Commission. Such xcess of catch can not in any case exceed 25 per cent of what is used for human food.

Senate Bill No. 644. By Senator Lyon.

Kelp Harvesting.

A new act which supplements an act regulating the cutting and harvesting of kelp.

The present law worked all right durng the period of the war when kelp potash brought a very high price, making it profitable to cut the kelp and transport it long istances to the reduction plants. The onditions are different now and all of the elp companies have ceased to operate. The price of potash has fallen to such a figure that it will not pay any company o engage in the kelp reduction industry unless by-products in addition to potash can be made use of and even then they cannot operate profitably unless they are ssured of a continuous supply of kelp close at hand. Under the old law any licensed company could cut kelp on any of the beds which had been declared open for cutting by the Fish and Game Commission. The result of this arrangement was that many companies wished to cut in the beds located near the better harbors and these beds were quickly exhausted, compelling the companies to frequently go long distances for their supply of kelp.

It was to encourage the reestablishment of the kelp industry by leasing to a company those kelp beds or positions of beds which lie close at hand, that this bill was drawn.

Senate Bill No. 811. By Senator Scott.

Shrimps.

Amends section 628 of the Penal Code.

Provides that the unmarketable shrimps which are taken in district 13 (South San Francisco Bay) while fishing for the fresh shrimp market, may be dried.

After much experimenting it has been found that the small shrimp unsuitable for the markets, cannot be screened out and returned to the water alive as was intended under the old law. The shrimps are easily screened after cooking for they are then doubled up and the small ones screen out, but efforts to screen them before cooking failed. The smaller shrimps are perfectly good for drying purposes and this law will prevent a considerable waste and possibly result in a reduction in the price of fresh shrimps.

Assembly Bill No. 485. By Mr. Gray.

Districts.

Amends the act dividing the state into fish and game districts.

The changes in this act which will affect commercial fishing are:

District 7 is extended to the south line of Mendocino County in order to take in the salmon trolling territory at Fort Bragg and Shelter Cove which need different regulations from the rest of district 10 in which they were before. (See under Assembly Bill No. 832.)

Vallejo Channel and the lower end of Napa River are stricken from district 12 B, thus throwing them into district 2, where netting is prohibited.

The southern limit of the netting district, 12 B, is placed at the right of way of the Santa Fe Railroad instead of the south boundary of San Joaquin County. Netting south of the Santa Fe right of way is prohibited.

Districts 20 and 20 A (Catalina Island) re changed. District 20 will extend from South East Rock to Lions Head, taking in about two-thirds of the waters on the ast and northeast side of the island. District 20 A will consist of the remaining tate waters surrounding the island. Jnder the provisions of Assembly Bill No. 831, netting is permitted in district 20 A, but in district 20 netting is not only unlawful but the possession of nets in the district is prohibited.

Assembly Bill No. 830. By Mr. Stevens.

Striped Bass; Shad.

Amends section 628 *a* of the Penal Code.

Closes the fall netting season for striped bass and shad on September 17, instead of September 25, thus conforming o the new closing date for salmon netting.

Provides that no more than five salmon may be taken per day in district 2 and prohibits taking striped bass less than twelve inches in length with hook and line. The minimum size which may be taken with nets remains at three pounds. Prohibits the possession or sale of striped bass weighing more than ten pounds, during the months of April and May.

Provides that striped bass which are legally taken during the open season may be held through the closed season of June and July under regulations to be prescribed by the Fish and Game Commission.

Assembly Bill No. 831. By Mr. Stevens.

Nets and Lines.

Amends section 636 of the Penal Code.

Provides that gill and trammel nets of not less than seven and one-half inch mesh may be used for salmon only during the months of June and July in district 12 B.

Prohibits the possession of beach seines, ound-haul or purse nets in districts 12 nd 12 B.

Prohibits the use of fyke nets for taking cat fish.

Permits the use of crab traps in those districts where crab nets are allowed.

Prohibits the possession of nets in district 20.

Assembly Bill No. 832. By Mr. Stevens.

Salmon.

Amends section 634 of the Penal Code.

This bill is of importance for it places further restrictions on the taking of salmon which show that they are in need of additional protection. The suggestion for salmon conservation made in the last issue of California Fish and Game were largely followed in this bill. The rapid increase in the catch by outside sea trolling, left the salmon insufficiently protected. It was the object in this bill to cut down the catch about equally in all districts and not cut down the river catch alone as suggested by the outside trollers, or cut down the outside catch alone as suggested by the river fishermen.

The upper Sacramento River district 12 A netting season was reduced fifteen days so that the open season for that district is the months of January to April, inclusive. For the balance of the river, the fall netting season was closed eight days earlier. These eight days are taken from the time when the run is heaviest and amounts to much more than the short time would indicate. This provision will cut down the river catch a little over 10 per cent.

A closed season is provided for Monterey Bay of January, February and March, which will cut down the catch in pounds at that point about 10 per cent. As this season comes at a time when small, immature salmon are taken in numbers the saving in numbers of fish is more than the saving in weight indicates. A closed season from March 1 to April 15, is provided for district 10 and a closed season of March and April for district 7. These two last are outside trolling districts and the closed season is to protect the immature salmon which are caught at the beginning of the season.

The bill provides that Eel River be closed to the use of nets after January 1, 1922, but permits the commercial taking of salmon on the lower river by trolling during the months of September, October and November.

Assembly Bill No. 1015. By Mr. Benton.

Croakers, Halibut and Barracuda.

Amends section 628 *c* of the Penal Code.

Prohibits the sale of California whiting, yellow-fin and spot-fin croakers. The sale of California halibut under four pounds in weight, or of barracuda under three pounds in weight or of albacore under six pounds in weight is prohibited as in the old law. In addition to the nonsale of these last three kinds of fish, this bill prohibits the possession of over fifty pounds of undersized fish.

FISHERIES NOTES FROM SAN PEDRO

Eight fishermen were arrested and convicted during April and May, 1921, for violations of the state fish laws pertaining to district 20. One of the heaviest fines imposed was meted out to Tony Marincovich, a San Pedro fisherman, in the justice's court at Avalon, Catalina Island, on May 13, 1921. Defendant in this case was fined $500 with the suspended jail sentence of one hundred days for maintaining a net in district 20 in violation of section 636.

The first albacore taken by a local boat this season was brought to San Pedro on June 8. Six fish averaging about sixteen pounds each were taken with jig lines.

The new fireproof cannery of the Halfhill Packing Corporation, recently completed on Channel 3 at Long Beach, is being put in readiness for the tuna season. In the meantime this company will pack chicken.

A decision that may affect the common practice by canneries in receiving tuna "subject to condition after cooking," was given by Superior Judge C. S. Crail at Department 4 in Los Angeles on June 9, in action brought by the crew of the "Golden Gate" for fish refused as unfit for canning purposes. Judgment was granted in favor of the plaintiff for seven and one-half tons of spoiled fish. This decision may result in fishermen taking more care with their catches on account of the possibility of canners refusing any fish that looks doubtful.

The boat "Kotobuki," Captain M. Yamamoto, arrived in San Pedro on June 13, with eight and one-half tons of seaweed (*Gelidium sp.*) taken in Mexican waters. The entire load was consigned to the American Agar Company in Glendale, California, which company is engaged in manufacturing agar-agar. This seaweed was taken near Point Banda in approximately three to four fathoms of water by means of hooks attached to long poles.

PACIFIC FISHERIES SOCIETY MEETING.

The Pacific Fisheries Society will hold its annual meeting at the University of California, Berkeley, on August 4, 5 and 6. Some interesting papers will be read and discussions held on the development and conservation of the commercial fisheries as well as on the subject of sport fishing. The meetings will be of interest to those engaged in the fishing industry as a business, as well as to those interested in problems of conservation, for an effort will be made to get these two factions into close touch with each other. The final program will be announced about the middle of July. Some of the papers will cover the following subjects: Whales and Whale Fisheries of California; Seals and Sea-lions of California and their relation to the Fisheries; Fisheries Investigations of the California Fish and Game Commission; Future of the Pacific Coast Salmon Industry; Relation of Hydro-electric Power Development and Irrigation Projects to the Salmon Industry and to Trout Fishing; Fish Canning and Inspection; Fisheries Schools, etc.

The affiliated societies of the Pacific Division of the American Association for the Advancement of Science will also meet at Berkeley during these three days. The public is invited to these meetings. Papers relating to the fisheries will be given before several of these societies and any one attending the meeting of the Pacific Fisheries Society will have an opportunity to hear them.

Saturday, August 6, will be given over to many field excursions to visit places of scientific interest and to visit the local fisheries. Further information may be obtained from the secretary of the Pacific Fisheries Society, Mr. George F. Sykes, Corvallis, Oregon, or from the Department of Commercial Fisheries of the Fish and Game Commission at San Francisco.

STATE FAIR EXHIBIT OF FISHERIES

The Fish and Game Commission has secured twenty-four by forty feet additional space in the main exhibit building at the Sacramento State Fair and will enlarge the scenic and live fish display which has been one of the most attractive exhibits at the fair during the past two years. An area of sixteen by forty feet will be devoted to an educational exhibit of the state's fisheries resources and to the fisheries conservation work of the commission.

NOTES FROM THE STATE FISHERIES LABORATORY.*

WILL F. THOMPSON, Editor.

THE PERSONNEL.

The Fish and Game Commission has lost the services of Miss Helen M. Edwards, who married Mr. Samuel Bacon the latter part of April. Miss Edwards has been acting as scientific assistant to Mr. Thompson during the stay at Hopkins Marine Station, Pacific Grove. Her place will be hard to fill, but nevertheless, the best wishes of all with whom she has been connected in her work go with her.

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*California State Fisheries Laboratory, Contribution No. 28.

The listing of small publications of members of the laboratory force together with the Fish Bulletins issued by them has led to some confusion. Hereafter these will be numbered as sent to the printer, not according to the date of printing. The correct numbers are as follows:

Fish Bulletin No. 4, contribution No. 22.

The Future of the Sardine, California Fish and Game, Volume 7, No. 1, contribution No. 23.

Notes from the State Fisheries Laboratory, in California Fish and Game, Volume 7, No. 1, contribution No. 24.

The Abundance of Young Pismo Clams, in California Fish and Game, Volume 7, No. 2, contribution No. 25.

Quarter-oils or Half-pound Ovals, in California Fish and Game, Volume 7, No. 2, contribution No. 26.

Whales and Sardines, California Fish and Game, Volume 7, No. 2, contribution No. 27.

Besides Miss Edwards, the commission has had Mr. Thompson and Mr. W. L. Scofield at the Hopkins Marine Station during the past year, pending the construction of the new laboratory at San Pedro. In anticipation of the beginning of building operations, Mr. Thompson has transferred his residence to San Pedro. This has somewhat crowded the quarters there as they are now constituted, but it is hoped that this will not be permanently the case. Mr. W. L Scofield has also left the Hopkins Marine Station, going to Palo Alto, where he will work at Stanford University for several months. This leaves no one at present in Pacific Grove. The Fish and Game Commission owes much to the Marine Station for the space kindly granted its workers.

During the coming summer, Mr. O. E. Sette will be engaged in work for the commission in continuation of his sardine studies which he has been pursuing at Stanford University. He will make his headquarters at San Pedro with the other members of the laboratory staff.

THE LIBRARY FOR THE NEW LABORATORY.

The work of collecting a library for the scientific work to be carried on in the new laboratory has been under way some time. There have been many difficulties in the way, such as the unsettled conditions in Europe, the determination of the method of purchasing such periodicals as are desired, etc., but it is now hoped that the more serious of these have been overcome. There are now on our shelves the complete publications of the Scottish Fishery Board, together with those of the Irish and British governments; the Reports and Bulletins of the Bureau of Fisheries of the United States; the Reports of the Dove Marine Laboratory; the Danish, Dutch and Norwegian government publications; those of the Canadian government; of the states of Rhode Island and Massachusetts; of the Province of British Columbia; and many separate volumes bearing on fishery matters. We have to thank the Dove Marine Laboratory, Prof. E. E. Prince of Canada, the Danish, Dutch and the Norwegian Fishery authorities for their generous donation of literature. There are now well toward completion the negotiations for the purchase of all the well-known scientific journals which are specially devoted to the subject of fisheries, and it is hoped that by the time the next issue of CALIFORNIA FISH AND GAME appears, we will be able to record the arrival of many of these. The low exchange value of the money of various European nations has rendered the purchase much less expensive than would have been the case previous to the war.

It is unfortunate that some of the sets obtained, notably that of the Bureau of Fisheries of the United States, are somewhat incomplete because certain numbers are out of print. We greatly desire to obtain these, however, and would be much obliged to anyone assisting us by the donation of odd issues of the various sets we may desire.—W. F. T.

THE BASKING SHARK AT MONTEREY

The Basking Shark, known to science as *Cetorhinus maximus*, has been recorded several times from Monterey, but its occurrence is nevertheless an interesting event, especially to the fishermen. This giant shark, with its gill openings extending well around toward the front of its throat, always attracts much attention when brought ashore. At Monterey it is usually taken in the lampara or gill nets, in which it becomes entangled until it is supposed to smother to death by the closure of the gill openings. It does great damage to the net in the meanwhile, and the fishermen do not welcome it. On May 3, 1920, a specimen was brought in to the wharf at Monterey, and measured by W. L. Scofield, who found it to be twenty-two feet long from the tip of the snout to the end of the tail. Again, in April, 1921, a specimen twenty-four feet in length was brought in by a lampara fisherman. In the endeavor to recoup some of the loss caused by the damage to his nets he exhibited the great shark for an admission charge. It is said that he failed in the venture.—W. F. T.

A RAG FISH AT MONTEREY.

There are several "rag" fishes found on our coast, one of which is hereby noted as occurring at Monterey. Mr. Higgins has had the good fortune to find a still rarer member of the group, and describes it below. The specimen found at Monterey was *Icosteus aenigmaticus* of Lockington. It was taken during 1919, but the date and place of capture, save that of Monterey Bay, was not recorded. The specimen at hand is twenty-three centimeters in body length, and twenty-seven and three-tenths in total length.

The salient characters of this "rag" fish are its lack of stiff bones, which makes it much like a thick, flat, bundle of rags, its yellowish color with purplish spots of irregular shape, and the row of spined scales along the lateral line. The fin rays are all of them covered by small spinules. It is very evidently a fish from the deep water, but just what depth we cannot surmise. It may be a pelagic.—W. F. T.

A STRANGE RAG FISH AT SAN PEDRO.

Closely related to the family of rag fishes, of which *Icosteus* is the typical genus, is the little known species, *Acrotus willoughbyi*, Bean. A specimen was taken in a mackerel net off San Pedro, March 31, 1921, and brought to the wholesale markets. We were unable to obtain the specimen as it was sold for exhibition, but careful measurements were made and there can be little doubt of its correct identification.

The fish was fifty-seven inches long, fourteen inches deep, and rather flattened laterally. The body was very limp and yielding as in other members of this group, due to the cartilaginous nature of the skeleton, the flesh was soft, and the naked skin tender and easily broken. The mouth was large, with thick lips, the nose broad and rounded, resembling with its large nostrils the muzzle of a calf. The fish was so fragile that it was somewhat mutilated when it reached the market, the gaff having torn through the jaw when landing the fish from the net.

The first or type specimen was taken in 1887 on the coast of Washington, apparently thrown up from deep water in a storm. Another was taken there subsequently, and one was taken at Monterey. This occurrence is especially noteworthy as the species has rarely been seen by naturalists and has never before been taken on this part of the coast.—E. H.

CUTLASS FISH TAKEN OFF LONG BEACH.

Following the practice of noting the unusual, the occurrence of the cutlass fish, *Trichiurus lepturus*, Linnaeus, which has recently come to the notice of the laboratory staff, entirely incidental to the regular work, may be here recorded.

Two specimens were taken, one on the first and another on the fourth of January, 1921, off Long Beach, in from three to five fathoms of water. They are each about two feet long, one and three-quarters inches deep, and very much compressed laterally. The mouth is large with long sharp teeth, the eyes large, and the skin is naked and of silvery color. The dorsal fin extends the length of the body to the long thread-like tail.

The species is common in the West Indies, and has been reported on the Atlantic coast as far north as Cape Cod. It is known in the Pacific from Panama, Lower California, and Japan, but this is probably its first appearance in this region.—E. H.

THE GRUNION.

The traditional spring spawning runs of the grunion on the sandy beaches of southern California have created the usual excitement at Long Beach this spring. These little fish, as described by Mr. Will F. Thompson in Fish Bulletin No. 3, come up on the beach with the high tides of the second, third and fourth nights following the full moon of the spring months, to deposit their eggs in the sand away from their enemies in the ocean. Although the deposited eggs are free from most enemies, great numbers of the spawning fish are taken by the "grunion hunters," who gather on the beach at about high tide and capture the fish as they are left on the sand between waves.

On March 23, the first night upon which a run might be expected, no fish were observed to be spawning. No observations were made on the two following nights, but during the second scheduled run, April 24, 25 and 26, large runs were observed on all three nights.

Runs were also reported to have occurred during the high tide of the new moon period early in May, but the extent and dates of these runs are not known. The full moon run in May, seemed to be a little out of the ordinary, as on the first night of the run, May 23, a considerable stretch of beach was carefully watched, but no spawning fish were observed, only a small number being seen in the surf. The presence of the fish in the surf was also made evident by the capture of quite a number by the use of a net in the shallow waves. On May 24, the run was but little better than that of the night before. The many people who scanned the beach were able to collect a few fish by wading out into the shallow receding waves, but very few fish were observed to be spawning. The results of a search for eggs in the sand on May 25, verified the conclusions from the observations of the two nights before, for only two pods of eggs were found as the result of quite extensive digging. The run of May 25 seemed to be normal in every way and many people who had searched the beach in vain the two previous nights were well paid for their efforts with a good supply of fish.—H. B. H.

LIFE HISTORY NOTES.

INTRODUCED DOVE THRIVES IN LOS ANGELES.

The Chinese spotted dove (*Spilopelia chinensis*), as a resident of Los Angeles first came to my attention in 1917, when a dead bird was found by school children in Hollywood. The skin of this specimen was preserved and is now in the museum of the Nature Study Department of the Los Angeles County schools.

At that time it was said to be common in a restricted locality in northern Hollywood. Reports of its occurence have increased in frequency and from a much wider area, until in the first week of April, a bird was noted by the writer, at close range, near the museum in Exposition Park.

Various reports as to the origin of this colony have not satisfactorily established whether the progenitors were liberated, or whether they were escaped cage-birds. The fact remains that the species is firmly established, and as a city-dweller, safe from hunters, is rapidly increasing in numbers.—L. E. WYMAN, *Museum History, Science and Art, Los Angeles, California.*

MOUNTAIN LION SWIMS RIVER.

It seems to be the general belief that the mountain lion is very shy of water, and that he will go out of his way in order to avoid crossing a stream when it is necessary for him to swim. My experience in trailing lions does not bear out this impression. In fact, two male lions which I killed at different times in Shasta County were voluntarily swimming the McCloud River, at different places, on every trip around their beat. Deer were as numerous on one side of the river as on the other, so it was not necessary for the lions to cross in order to get food. And as in each instance, the tracks were several hours old, it is apparent that these lions did not swim the river to confuse or avoid the dogs, but that they were merely following their natural instinct.

Another instance of this kind was in January, 1921, when I was hunting from Kinsley Ranger Station, Mariposa County, in the company of Mr. Joseph Dixon of the Museum of Vertebrate Zoology. After several days of storm, the weather cleared about dark on the evening of January 19. There was about six inches of snow on the ground when we left camp early on January 20. At about 9 a. m. we found the track of a large male lion on Grizzly Mountain. The tracks were about twelve hours old when we found them, which was indicated by the condition of the snow where the tracks were made.

On account of the dense brush in places we were unable to keep up with the dogs. As a result, by the time we had trailed the lion about six miles south to the north rim of the Merced River, and at a point about 2000 feet above the river, we could just faintly hear the hounds baying as they crossed over the south rim, at about the same elevation. We hurried down the mountain to the river and soon found the tracks of the lion and dogs entering the water on a sand bar at about 600 feet west of the mouth of Slate Gulch and about three miles east of Briceburg.

I was sure that the dogs would tree the lion before night, so that I was determined to follow them, although Mr. Dixon had had to return to Berkeley. As the river was about 100 feet wide and too cold and swift to swim with safety, I decided to build a raft. I stopped a passing telephone lineman and got some spikes from him. Then I gathered some discarded railroad ties and driftwood and built a raft at the upper end of a pool. Using a piece of driftwood for a paddle, I ferried across. The dogs had crossed the river at about 12 o'clock noon and by the time I had built the raft and crossed to the south side it was 2:30 p. m.

I soon found the track of the lion and dogs climbing the mountain on the south side of the river. After trailing them about two miles up the ridge toward Filiciana, I heard the dogs barking "treed" in the head of a short canyon on the west side of Slate Gulch. When I arrived at the tree, the lion jumped out, but treed again about a hundred yards farther up the canyon. He was lying in the narrow fork of a tall live oak and when I shot him through the heart with the revolver, he sank into the fork and died.

Then I climbed the tree and tried to dislodge him, but as he weighed about 160 pounds, and as it was necessary to lift the carcass about four feet to slip the hips through the fork, I was unable to free him. I then thought of cutting off one of the forks with my skinning knife. By this time, it was getting quite dark and a storm was threatening, and with a hard, rough trip of two miles down the canyon and the river to cross, I decided to cut the carcass in two behind the shoulder and drop the front half to the ground, leaving the rear half in the tree.

By the time that I reached the river, it was quite dark and as the raft had drifted half way down the pool while I was crossing earlier in the day, I was forced to abandon the raft, on the return trip, near the north bank, and wade out to avoid being carried into the rapids. I now walked three miles down the river to Briceburg where I arrived about 8 p. m., after being on the trail fourteen hours.

This lion had crossed the river probably ten hours ahead of the dogs and was following his regular beat as I found his old tracks while trailing him on the south side of the river. There was also the skeleton of a calf near the place where the lion was treed. He had probably been killing cattle there during the summer.—JAY C. BRUCE, *San Lorenzo, California.*

CURLEW NUMEROUS.

Since its protection, the Hudsonian curlew (*Numenius hudsonicus*) is becoming more numerous again, in this vicinity. I have lived and hunted in this country around Rio Vista from boyhood and have entertained a number of the most prominent sportsmen from many states on my reserve, and I have naturally taken a keen interest in the wild game life of the locality. I have heard the old settlers here tell how the jack curlews were upon these plains in countless thousands at one time. Whether they were killed off or inhabited another region, I am unable to relate, but I do know that for the last twenty years at this season of the year we have only seen an occasional flock. However, about a week ago I noticed a flock of about one hundred of these birds on the pasturage grounds each day. The flock has been increasing until it has reached about five times its original size. On April 26, 1921, about sunrise, I saw a flock of about five thousand which all seemed to be whistling at the same time. I was greatly astonished, as I had never seen these birds in such numbers before. This large flock did not stop in this vicinity, but traveled straight on southward; and each day I have seen curlew still migrating to the south, but not in such great numbers. There are a great many here at present, yet they are not so numerous as they were a week ago. They are evidently traveling to a new feeding ground.—S. C. CHURCH, *Rio Vista, California.*

ALBINO DEER SEEN IN THE STANISLAUS FOREST.

On February 1, of this year, Ranger Freer saw a white or albino mule deer in the Stanislaus National Forest. Several months later, on May 7, when Ranger Freer and former District Ranger Fowler were out repairing telephone lines they again saw an albino deer. These two records of the appearance of an albino deer were of unusual interest to us.—J. V. Wulff, *Sonora, California.*

A TRAPPER'S EXPERIENCES.

I laid out my first line of traps on the twenty-fifth of October, 1920, stringing them from Logan Meadow north to the junction of the main and West Chiquito creeks, crossing here and keeping along the ridge until opposite Placer Station, where I crossed over and continued north to Arnold meadow. Then I crossed back to Logan via Mebold and Summit meadows, covering about thirty miles each day. Of course, I later varied this line in several respects, at one time running up the Joaquin to Squaw Dome, and again trapping the other side of the river as far down as Kaiser crossing.

My first catch, on the twenty-sixth of October, consisted of three grey foxes and one skunk. All of these skins were exceedingly blue and unprime, so I set all traps off that day and left them until the fifteenth of November, and even then I caught foxes that were not at all prime. In my mind there is not the slightest doubt but that the trapping season is at least one month too early even for that country; yet there are always trappers at work on the first day of the season (October 15) as low down as Finegold. Then they wonder at the prices which they receive for their furs.

For coyote bait I used squirrel meat ground very fine, to which I added a small amount of tincture of asafetida (God only knows how to spell that word—but you know what it is—I used to wear it around my neck to prevent diseases when I was a kid) and some oil of rhodium. I set three traps in a Y form, driving a stake through the rings completely out of sight, and covering the whole thing over very carefully. In the course of two months, I was able to so set such a group of traps that the coyotes would take enough notice of it to turn a trap over once in a while, or scratch the bait from the center of the set. I then found that they were suspicious of any set that was bounded on any side by any obstacle whatever—and after that I set them in the openings; and this was the secret of the whole game. I caught seventeen of these so-called coyotes in a very short time. A peculiar thing about them is that, while in the trap, at least, they will utter no sound whatever and, instead of striving to get away, they will simply grovel in the dirt like a domestic dog trying to beg forgiveness; also they will positively not meet your eye. On the contrary with the grey fox—they are continually on the prod and will growl, snap and bark from the time they see you until they are dispatched. I also caught a large black eagle in one of these sets, and he was as docile as a chicken, not even hissing at me when I let him out of the trap. Later I caught another of these birds, but the coyotes found him first and left me only his two feet.

I spoke to you about finding the carcasses of eight deer that had undoubtedly been killed by coyotes. These kills were always in the deep snow and one could visualize every move that was made. In each case the deer was chased by not more than two animals—sometimes only one—and caught by another as he circled back over his trail. I have always read that these animals hamstring a deer, but in so far as I could tell these deer were pulled down from in front by a nose hold, and when you take into consideration the size of these coyotes it does not seem at all impossible. My largest was sixty-two inches long and would weigh something over 100 pounds, but the average was better than fifty-eight inches from tip to tip, and just that much bone and muscle. In broad daylight I saw one carrying a full grown badger by holding it in his teeth and throwing the weight over his left shoulder. When caught in a trap they will tear manzanita bushes over two inches through into the smallest shreds. The one thing I couldn't understand about these killings was that they were all large deer and mostly bucks. It was some little time after the rutting season and after the bucks had plenty of time to regain strength. The last one I found was about the twenty-fourth of February, and as I attempted to lift the head both horns came off in my hand. This for your information regarding the time deer drop their horns at that elevation. This was a perfect four-pointer.

During my stay in there I saw but one loin track, and though I followed for several miles I could not find where he had either attacked or molested any deer. I am, therefore, of the opinion that a great many of the kills with which lions are blamed should go to the coyote. J. T. Hogue told me that he had found a great many deer killed by lions in his time, but he admitted that he had seen no sign of a lion at a great many of these carcasses and had simply taken it for granted that it was a lion. When the Teafords were in there hunting lion and bear last winter they saw one lion track—this lion had come from Shake Flat across country to the Soda Springs on West Chiquito and straight through to Jackass—in a straight line and with never a stop, although he was passing through a country that literally swarmed with deer of all kinds. Certainly, at that time of year he was going straight through and out of the deer country, and though the boys followed him for two days he did not stop or make a kill of any kind. George Teaford and W. B. Day, both old-timers, tell me that they have seen deer killed by single coyotes—and since these animals of which I speak are not much smaller than the old timber wolf, it does not seem at all impossible.

Unless the price of fur goes up to a point where it will pay to trap these coyotes, or until a bounty is placed on them by the county, it will be but a very few years before they do some real damage to the deer. Of course one wonders why they have not reached such numbers in the past as to have exterminated all of the deer, but I think that civilization is concentrating the deer and the coyotes into such a small tract of land in the hills that the coyote is gaining advantages every year—especially during the hard winters. This same question is asked about the tree bettles—why they haven't destroyed all the timber before, since they were left alone for years—while I know there is a real reason I don't know what it is.

As for deer—our first few months in there we saw great numbers of does, and with every doe there was at least one fawn and sometimes two. Wagner told me that there were a great many barren does, but all the barren does I saw had their fawns close by. And that reminds me of another peculiar thing. There was a cave on the Logan side of the river where I thought there might be a bear or so, and while I was sitting there one day waiting for the dog to come up, so I could send him in, I saw an old doe and two fawns come down to drink on the other side of this river. It was the twenty-sixth of November and the deer had just started running, the first signs of this being on the twenty-fifth. This old doe led both fawns down and they started to drink. As soon as she saw they were busy at it she started up the hill on a dead run, but they heard her and caught her before she had gone 200 yards. She walked calmly back to the river with them again and started them to drinking again. This time she made her get away, although the poor little devils ran and bleated around there for half an hour, until they finally laid down under a big oak and tried to forget it. I do not know that this is the way the doe gets away from her fawns at this time of the year, but this I did see; and I also know that after the season of mating is over she comes back to her fawns again. During November and part of December these little devils were all alone, but at the time we left the hills—February 27—every doe had her fawns with her and seemed as loving to them as ever. The whole trip was the most interesting I was ever on, and I really believe I learned more about nature in those five months than during my entire life.

I had an interesting experience with a skunk. It has been my belief that I was a regular skunk trapper and on this particular day I found a large one in a trap on a sloping hill. The idea is that if you get their hind feet off the ground (their rear muscles being the ones that work the scent bag) you can kill them without smelling up the fur. I, therefore, lifted this fellow off the ground with a pole and hung him by one of the springs of the trap in a manzanita bush. I then walked up very close to him so as to be able to shoot him through the brain. As I did so he reached one leg behind him, got a purchase on one of the limbs of the bush and shot me square in the eye and ear, at the same time dropping down out of the bush, where he proceeded to work on me from the ground up. As soon as I had sufficiently recovered to open one eye, I took a squint at him and he was sitting there calmly chewing on the fish head with which I had baited the trap. This calmness of theirs impresses me more than anything else that they do, except, of course, the thing I have just mentioned. When you come on them in a trap they will invariably look up at you for an instant and then go on eating, or picking their teeth, or whatever it may be that they are interested in.

After the twentieth of November the large bucks started to come down from the high country, though the spikes and forked horns had been running wild a week previous to this. After that the ground was torn up in huge chunks on every hillside and opening, in the entire forest. It was not my luck to see any real fights, though I heard one time a clashing of horns in the brush within thirty feet of the trail that must have meant trouble. Also, two of the last coyotes that I trapped had large unhealed gashes in their heads and along their sides that could have been made by horns only.—Roy H. Blood, *Madera, California.*

AN OPOSSUM SEEN IN PACHECO PASS.

Last summer I was driving from Fresno to Monterey via Pacheco Pass, when about fifteen miles out from Hollister and east of that place I saw something which at the time I believed to be a cat. Although dark, I had a strong spot light and by using it I could see the shining eyes of the animal. I brought the car to a sudden stop and ran up to where it was lying, whereupon, it started to walk off. I grabbed a small stick and hit it lightly. It lay as if dead—it not only was playing possum, but it was a possum! It had the long slick tail which is similar to the tail of a rat. The hair was gray and white tipped and the face was the bald face of the opossum (*Didelphis virginiana*). I picked it up and held it for a few seconds, but it began to squirm and when I dropped it it ran into the shrubs at the side of the road and was gone.—R. D. Libby, *Fresno, California.*

THE OPOSSUM IN VENTURA COUNTY

Being a southerner and having had, last November, a fine opossum (*Didelphis virginiana*) killed by a friend, and baked with sweet potatoes in the true southern style by an old negro from Dixie, I was particularly interested in the item published in the January number of California Fish and Game.

The opossum, a male, was killed in Ventura County, about two miles up the Santa Clara River from the mouth and was the first one ever heard of in this vicinity. It was larger than any I ever saw in the south—California must agree with them.

Since this opossum was killed, I have heard of two being caught near the line of Ventura and Los Angeles counties, but these were only reports. I did not see the animals myself.—Geo. P. Austin. *Oxnard, California.*

CONSERVATION IN OTHER STATES.

MUSKRAT SEASON CLOSED IN MINNESOTA.

In October, 1920, the department sent out thousands of questionnaires asking for information and an expression of opinion from trappers, fur buyers and dealers, farmers and sportsmen as to what steps should be taken to preserve a breeding nucleus of muskrats.

Fully 90 per cent of the answers favored an immediate closed season. The commissioner petitioned Governor Burnquist for additional protection which was duly granted and order No. 2 was issued protecting muskrats until the close of the 1921 regular session of the Minnesota legislature.

It developed later that muskrats were still numerous in some localities and complaints of the damage to highways and grades poured in so rapidly that the department could not possibly investigate them all. Whereupon another petition was prepared asking for a lifting of the ban in thirteen counties. This was acted upon favorably by Governor Preus and order No. 3 was issued.—*Fins, Feathers and Fur,* December, 1920.

SPORTSMEN'S CLUBS IN NEW YORK

"There are today in New York some 475 sportsmen's clubs comprising a membership of about 40,000 hunters, fishermen, and other conservationists. Even this total, however, is smaller than it should be, in view of the fact that last year some 300,000 persons purchased hunting and trapping licenses in New York—to say nothing of the fishermen of whom no license is required."—*The Conservationist,* April, 1921.

INTEREST IN FISH AND GAME CONSERVATION IN UTAH.

Interest in fish and game conservation in Utah has been greatly stimulated through the efforts of the United States Forest Service, which has organized local fish and game protective associations and unified them into a state organization. Since October, 1920, more than twenty-five locals have been established.

ANNUAL DIVIDEND FROM FUR-BEARING ANIMALS OF NEW YORK STATE.

The game and fur-bearing animals of New York state, if capitalized, are worth not less than $53,000,000; they return an annual dividend of more than $3,200,000; and they cost the state for their protection and increase the nominal sum of $182,000. This cost of protection and increase is thus less than 6 per cent of the annual dividend.

REPORTS.

VIOLATIONS OF FISH AND GAME LAWS.

January 1, 1921, to March 31, 1921.

Offense	Number of arrests	Fines imposed
GAME		
Hunting without license	20	$200 00
Trapping without license	4	40 00
Deer—closed season—killing or possession	23	875 00
Does—spike bucks, fawns—killing or possession	4	475 00
Bear—closed season—killing or possession	1	10 00
Brush rabbits, squirrels—closed season—killing or possession	6	100 00
Quail—offering for sale—excess limit—killing or possession	10	350 00
Doves—closed season—killing or possession	1	25 00
Ducks—excess limit—closed season—killing or possession	12	250 00
Protected shore birds—killing or possession	8	225 00
Non-game birds—killing or possession	17	755 00
Night hunting	12	50 00
Shooting ducks from power boat	1	25 00
Mudhens—killing or possession closed season	1	25 00
Total game violations	120	$3,405 00
FISH		
Angling without license	10	$190 00
Clams—undersized—excess limit—taking or possession	12	310 00
Crabs—undersized—excess limit—taking or possession	16	360 00
Abalones—undersized—closed season—taking or possesion	19	627 50
Lobsters—undersized—taking or possession	1	25 00
Striped bass—underweight—taking or possession	9	155 00
Young fish—taking or possession	2	20 00
Barracuda—underweight—taking or possession	1	25 00
Sturgeon—closed season—taking or possession	1	20 00
Sunfish, crappie—closed season—taking or possession	5	40 00
Trout—excess limit—closed season—taking or possession	7	190 00
Illegal nets in restricted districts	18	595 00
Total fish violations	101	$2,557 50
Grand total fish and game violations	221	$5,962 50

SEIZURES—FISH AND GAME AND ILLEGALLY USED FISHING APPARATUS

January 1, 1921, to March 31, 1921.

GAME.	
Deer meat	376 lbs.
Quail	148
Ducks	857
Doves, pigeons	1
Rabbits, squirrels	12
Miscellaneous birds	30
Beaver skin	1
Pine marten skins	5
FISH.	
Striped bass	926 lbs.
Barracuda	8625 lbs.
Halibut	5669 lbs.
Sunfish	21
Trout	22
Crabs	2516
Abalones	317
Abalones	6497 lbs.
Clams, pismo	690
Clams, cockle	982 lbs.
Lobsters	1920
Lobsters	100 lbs.
Illegal nets	16
SEARCHES.	
Illegal fish and game	16

STATEMENT OF EXPENDITURES.

Period from July 1, 1920, to March 31, 1921.

Administration:		
Commissioners	$310 68	
Executive offices	19,169 10	
Printing	4,985 82	
Research and publicity	4,789 95	
Accident and death claims	1,427 61	
		$30,683 22
Commercial fish culture and conservation:		
Superintendence	$11,814 75	
Inspection and patrol	23,754 51	
Research	22,948 71	
Statistics	7,989 15	
Market fishing license commissions	375 50	
Propagation and distribution of salmon	19,739 93	
		86,622 55
Sporting fish culture and conservation:		
Superintendence	$11,203 55	
Printing	198 54	
Prosecutions and allowances	391 85	
Angling license commissions	12,627 40	
Fish exhibits	4,323 19	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	38,943 71	
Los Angeles District (40 per cent)	12,506 31	
Sacramento District (40 per cent)	21,413 88	
Propagation and distribution of trout	109,069 47	
		200,677 90
Game conservation:		
Printing	$267 18	
Prosecutions and allowances	970 73	
Hunting license commissions	19,134 70	
Mountain lion hunting (and bounties)	6,724 76	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	43,283 45	
Los Angeles District (60 per cent)	16,533 10	
Sacramento District (60 per cent)	32,123 74	
		121,173 59
Tahoe camping ground		402 11
		$439,559 37

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JANUARY, FEBRUARY AND MARCH, 1921.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Colusa, Butte, Tehama, Glenn	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican, brought into California
Albacore												45				45	
Anchovies								1,850		5,800		2,420		48,555		58,625	
Barracuda											33,041	352,118		332,060		717,219	1,757,921
Bluefish									1,523	16,772						18,295	
Boccaccio								41,043	111,986	347,674						500,703	
Bonito											30	21,671	8	20,203		41,912	22,587
Carp				15,184	35,788		14,857	40								65,869	
Catfish		37,761		5,831	16,386		7,173									67,151	
Chilipepper								22,985	2,513	32,277						57,775	
Croakers												57,327				57,327	295
Cultus Cod	487							35,109	7,727	28,161		297	26	527		72,334	
Dolphin																	
Eels																	
Flounders	9,629		465	1,448			3,060	18,926	9,031	910	105	885				44,459	
Grayfish							176	29,870		565		13,054	4,985	205,381		254,031	
Greenfish																	
Hake								6,690	12							6,702	
Halibut								1,417	472	2,064	69,125	500,138	46,761	202,063		822,340	236,258
Hardhead				324	26,976		34,657									61,957	
Herring	4,991		731				21,220	441,325		1,300	10					469,580	
Kingfish								3,952	30,128	887	32	113,696		1,145		149,840	315
Mackerel										1,442	2,313	704,749	9,952	72,647		791,133	29,684
Marlin																	
Mullet														433		433	7,670
Perch	16,129	62	24,169				14	16,709	1,610	13,998	7	21,795	82	2,066		96,641	3,898
Pike				589	1,815		2,329									4,733	
Pompano									37	174	16	3,622		20		3,869	305
Rock Bass											71	13,913	1,964	17,565		33,516	3 095
Rockfish	1,416		69					125,470	61,417	254,830	21,721	512,851	11,761	261,926		1,251,452	13,610
Sablefish								153,995								153,995	
Salmon	67		194	33,884	27,225	2,383	57,161	112.478	5,663	174,583						413,668	
Sandabs								148 623	13,528	1.313		1,437	5			167,906	
Sardines			98						92	1,479,625		17,200,790	822,175	1,451,914		20,954,694	
Sculpin												8,794		4,974		13,768	312
Sea Bass—Black												4,130		19,050		23,180	21,562
Sea Bass—White									146	110	1,358	43,293	142	39,194		84,243	85,439
Sea Trout												92	2,510			2,602	6,568
Shad				2,505	5,396		17,997	1,320	10							27,228	
Shad—Buck				477	824		4,419									5,720	
Shad—Roe				1,971	930		7,359									10,260	
Sheepshead											269	448		9,594		10,311	

Skates	--------	--------	--------	--------	--------	--------	--------	22,295	--------	1,662	--------	1,406	232	--------	--------	25,595	--------
Skipjack	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Smelt	8,978	--------	5,502	--------	--------	--------	4,221	51,338	221	4,830	22,629	50,129	921	13,771	--------	162,540	607
Sole	--------	--------	--------	--------	--------	--------	--------	880,307	35,500	14,595	7,224	48,145	729	6,166	--------	992,666	175
Splittail	--------	--------	--------	165	12,169	--------	159	--------	--------	--------	--------	--------	--------	--------	--------	12,493	--------
Striped Bass	--------	--------	272	9,457	8,622	41	130,414	15,942	--------	15	--------	--------	--------	--------	--------	164,763	--------
Stingaree	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	203	--------	1,555	--------	1,758	--------
Suckers	--------	--------	--------	--------	1,976	--------	85	--------	--------	--------	--------	--------	--------	--------	--------	2,061	--------
Swordfish	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Tomcod	--------	--------	--------	--------	--------	--------	20	15,078	--------	--------	--------	--------	--------	--------	--------	15,098	--------
Trout—Farm	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Trout—Steelhead	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Tuna	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	101	--------	2,209	--------	2,310	682
Tuna—Bluefin	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Tuna—Yellowfin	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	1,060	--------	--------	--------	1,060	--------
Turbot	--------	--------	146	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	146	--------
Whitebait	--------	--------	919	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	919	--------
Whitefish	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	12,082	--------	3,013	--------	15,095	600
Yellowtail	--------	--------	--------	--------	--------	--------	516	--------	--------	--------	--------	117,788	--------	76,920	--------	195,224	100,794
Miscellaneous	--------	--------	--------	49	--------	--------	--------	4,633	2,358	3,018	6,617	7,086	857	--------	--------	24,618	200
Total fish	41,700	37,823	32,556	71,884	138,107	2,424	305,837	2,151,395	284,004	2,386,605	161,901	19,818,565	903,110	2,792,951	--------	29,131,862	2,292,577
Crustaceans:																	
Crabs (doz.)	1,048	22	79	--------	--------	--------	--------	9,405	122	5	--------	--------	--------	--------	--------	10,681	--------
Ecrevisse (doz.)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Shrimps	--------	--------	--------	--------	--------	--------	--------	150,189	--------	--------	--------	639	26	--------	--------	150,854	--------
Spiny Lobsters	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	13,607	34,223	937	17,727	--------	66,494	383,279
Mollusks:																	
Abalones	--------	--------	--------	--------	--------	--------	--------	--------	--------	235,320	16,686	--------	--------	--------	--------	252,006	8,094
Clams—Cockle	5,466	--------	1,359	--------	--------	--------	--------	--------	--------	--------	276	--------	--------	235	--------	7,336	--------
Clams—Mixed	4,598	--------	13,519	--------	--------	--------	--------	--------	--------	--------	533	155	--------	--------	--------	18,805	--------
Clams—Pismo	--------	--------	--------	--------	--------	--------	--------	--------	957	--------	42,758	--------	--------	--------	--------	43,715	--------
Clams—Softshell	112	2,084	9,145	--------	--------	--------	29,089	12,553	--------	--------	--------	--------	--------	--------	--------	52,983	--------
Cuttlefish	--------	--------	40	--------	--------	--------	--------	2,217	6,333	13,316	--------	173	--------	--------	--------	22,079	--------
Limpets	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Mussels	--------	--------	--------	--------	--------	--------	40	--------	600	485	97	65	--------	--------	--------	1,287	--------
Oysters—Eastern (No.)	--------	--------	301,181	--------	--------	--------	--------	783,670	--------	--------	--------	--------	--------	--------	--------	1,084,851	--------
Oysters—Native	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Snails	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Squid	--------	--------	--------	--------	--------	--------	--------	--------	--------	32,623	--------	13,225	--------	39,964	--------	85,812	--------
Miscellaneous:																	
Frogs (doz.)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Terrapins (doz.)	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
Turtles	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	61	--------	--------	61	145
Scallops	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	636	--------	--------	--------	--------	636	--------

All amounts shown in pounds unless otherwise specified.

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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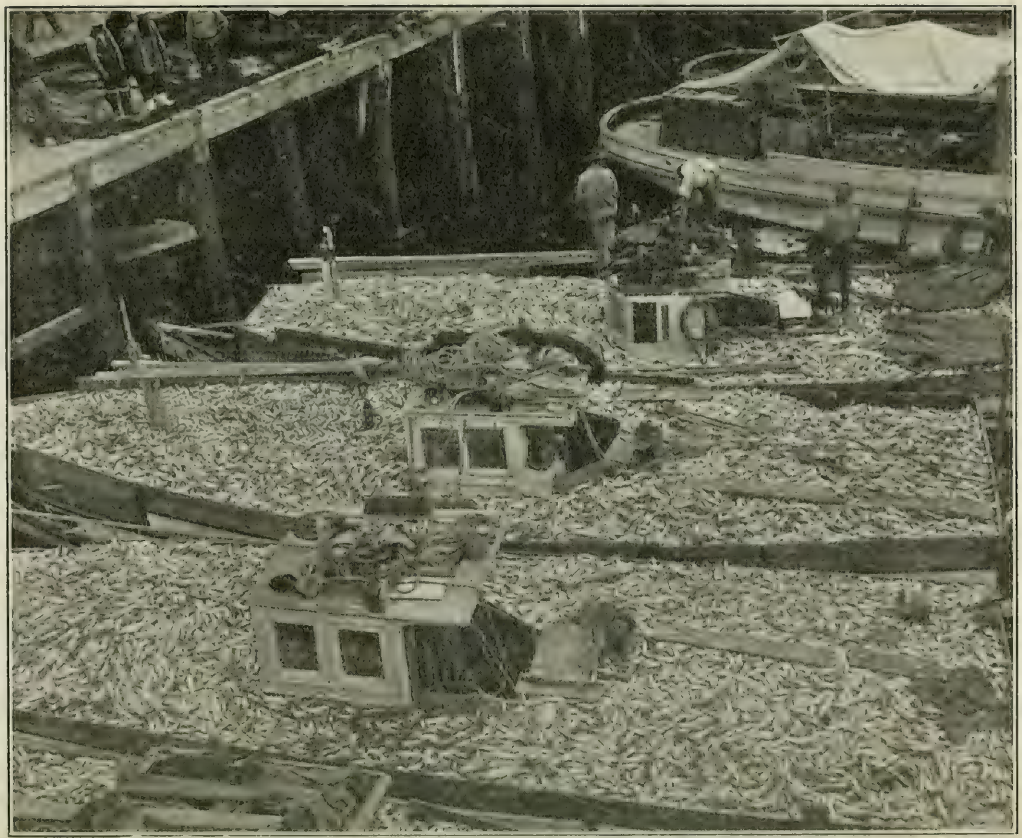

Fig. 54. Sardine boats waiting to unload, San Pedro. Photograph by E. M. Nielsen.

THE SARDINE OF CALIFORNIA.*

By WILL F. THOMPSON.

In this number of CALIFORNIA FISH AND GAME appear a series of articles upon the California sardine, dealing with the history of the fishery, the methods of catching, of canning, and the use of waste fish as fertilizer. They are not technical in nature, being designed for readers interested in fisheries in general, and do not attempt to speak authoritatively on debated points. The industry has been, for the past five years, an important one in California, and crucial years are ahead of it.

It should be understood, in the first place, that the sardine packed in California is a true sardine, in the sense understood by scientists of recognized standing.

This is not true of the "sardine" packed in Maine and other New England States. That is in reality a young herring, known to naturalists as *Clupea harengus*, whereas the true sardine is known as *Sardina pilchardus*. This herring is caught in great numbers along the Maine coast in weirs, or traps made in relatively shallow water. Its habits are different in many respects from those of the true sardine, for the eggs of the herring are laid on the sea bottom and attach themselves there, while the eggs of the sardine are laid free in the water and drift with the currents. The differences in structure, flavor, etc., are equally marked.

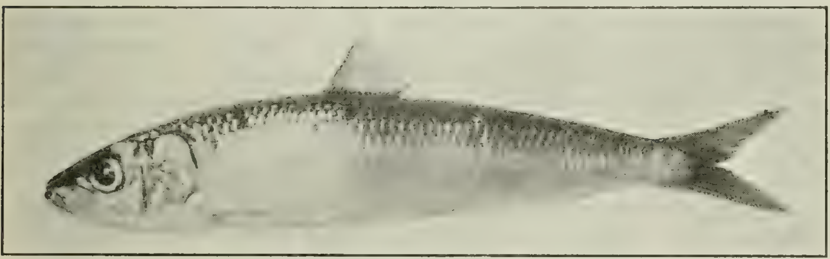

FIG. 55. The California sardine, a specimen without the usual spots. Photograph by H. B. Holmes.

The same remarks may be made about the Norwegian "sardines" save for the fact that among them one finds two species of fish widely different from the true sardine, namely the young of the herring, and the bristling, or young of the sprat, called *Clupea sprattus* by European writers. It is noteworthy that the English courts decided in 1916 that Norwegian fish packed as "sardines" could not be admitted into England under that name. According to the review of the court, bristling had been packed in oil in Norway since 1874, and they were at first called "Sproetten in oel," later "Sproetten a la Sardine," and finally "Norwegian sardines." The name sardine was therefore limited to the young of the pilchard, which are canned in France, Spain, Portugal and Italy as sardines. The pilchard itself is canned in Cornwall as pilchard. Later the Australian courts followed the example of the English.

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*California State Fisheries Laboratory, No. 30.

The true sardine, or pilchard, is found from England along the Atlantic coast of Europe southward into the Mediterranean, and the adjacent coasts of Africa. It has been divided into two races, or varieties, the one found in the Atlantic and known as *Sardina pilchardus pilchardus*, the other found in the Mediterranean and known as *Sardina pilchardus sardina*. It still remains to be carefully investigated whether the difference between these two subspecies, or varieties, or races, is less than exists between some of the other "species" of sardine.

There are, indeed, throughout the world a number of these very closely related species of sardines. Thus there is the sardine of the Pacific Coast of America, from Alaska to Mexico, known as *Sardina coerulea*, and that of the coast of Peru, known as *Sardina sagax*, perhaps belonging to the same species, but more likely not. There is a gap of considerable extent between the extremes of their distributions, namely the tropical waters of the Gulf of Panama, and careful examination of many specimens will some time be necessary to determine their distinctness. Nevertheless, they both are extremely closely allied to the sardine or pilchard of Europe, in habits, distribution in the sea waters, movements and structure. This is granted by every competent authority. They are the only true sardines found in the waters of the Americas, save, perhaps, a species found occasionally in the West Indies, for no sardine is found on our Atlantic coast.

On the other side of the Pacific there are found the Japanese sardine, *Sardina melanosticta*, and the Australian *Sardina neopilchardus*. These are both very close to the European species. There is also a sardine to be found in the waters of the Cape of Good Hope, known as *Sardina ocellata*. The interrelationships of these various species are very poorly known and the morphological characters upon which they are based are insufficiently studied.

However, it is very plain that they are entitled to the name sardine, or pilchard, in contradistinction to the young of the herring, or sprat.

Regarding their habits and rate of growth, not a great deal is known. It is known that the eggs are pelagic, that is, laid so that they float freely in the open ocean waters, and that the adults in the waters of Europe and America disappear before spawning. Whether they are subject to the great fluctuations in abundance to which the herring is, still remains to be seen. The California Fish and Game Commission has collected careful data which it is hoped will in due time throw light on the subject of habits, rate of growth, migrations, and the presence of great changes in abundance. If the results which have been obtained in work on the herring can be paralleled, they will undoubtedly prove of much importance.

The following articles are regarded in no sense as a part of this work, although they do, to a certain extent provide a basis for judgment as to the changes which may occur in methods of fishing and canning in the future. This is especially true of the article on fishing gear and methods. An article by Professor Starks of Stanford University has appeared, in the April, 1918, number of CALIFORNIA FISH AND GAME upon the scientific characters of the members of the sardine and herring family found in the waters of California, and anyone interested is referred to that publication.

HISTORICAL REVIEW OF CALIFORNIA SARDINE INDUSTRY.*

By Will F. Thompson.

The sardine industry in California is, as it now exists, essentially a product of the great war. Previous to its outbreak there had been a relatively small pack at Monterey and San Pedro, but the machinery for a vast expansion already existed in part in the tuna canneries of southern California. With the practical cessation of sardine imports into the United States in 1915, and the later great foreign demand, the pack of California sardines rose to great heights. Now with the coming of peace and the gradual return to normal conditions still so far removed, it remains to be seen how our new industry will meet competition. The development of fishing and packing methods have thus far been incidents only in the thorough upheaval of 1914, and the history to be here recorded gives little clue to how well fitted they are for survival. So, in a measure, this review is not a history, because it is written during the event.

Nevertheless, since the existence of methods, and a knowledge of the availability of the raw material, enabled the California sardine canners to so readily seize their great opportunity, the prewar period is of much interest. Failures and crudities naturally played their parts, as might have been expected, for a bodily transportation of fishing and canning methods from the great existing European and Maine fisheries was impossible. The California sardine is a true sardine, with vastly different habits than the young herring and sprat of the Maine and Norwegian fisheries. Where in Maine weirs may be employed, here nets must be used. And of course, the quality of the fish is also different, requiring different treatment. At the same time, the difference between French and American labor and physical conditions effectively precluded the introduction of French methods of canning save in a general way. It is highly to be regretted that even at the time of the outbreak of the war, cannery methods were still imperfect and that such packs as that of the round can had still to be tried.

THE PREWAR PERIOD.

The canneries.

The Golden Gate Packing Company of San Francisco was the first sardine cannery on the Pacific Coast. During 1890, 1891 and 1892 it put up 20,000 cases of sardines in quarter-pound cans of the usual type, 7000 cases of one-pound round cans, and 7000 of two-pound. But, so it was said, the appearance of the sardines was erratic, and this, combined with other causes, resulted in the sale of the machinery, and its shipment to San Pedro, where sardines were to be found more consistently.

There it was utilized by the Southern California Fish Company, managed by A. P. Halfhill. This concern continued to pack sardines in a limited way until 1909, but in the meantime, in 1906, it had begun packing tuna, and toward this its energies were principally directed until 1916. Other canneries, such as the Lower California Fisheries Company, the Pacific Tuna Canning Company, and the Premier Packing Company, all of San Diego; the Halfhill Tuna Packing Company, the South Coast Canning Company, and the Los Angeles Tuna Canning Company, of Long Beach; and the Van Camp Sea Food Company and the White Star Tuna Packing Company of San Pedro, began operations on the tuna. So that in 1916 there were ten firms engaged in packing this fish in southern California, with a long winter season when no tuna were available while sardines were. These firms provided the first great pack of sardines.

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*California State Fisheries Laboratory, No. 31.

In northern California no such parallel industry had prepared the way. But F. E. Booth had, in 1903, started a cannery at Monterey, and in 1906, the Monterey Fishing and Packing Company (later reorganized as the Pacific Fish Company) had established itself. Mr. Booth began in a small experimental way about 1902 in a shed on a back street in the town of Monterey. His real canning operations were begun in 1903 in a small building on the waterfront where his cannery now stands. He started with quarter-oils and a little later packed larger fish, calling them mackerel, to suit the market then existing. However, seven or eight years later, the federal government ruled that they would have to be labelled sardines. The early canning was done by the old method of hand flaking, drying in the sun, and hand soldering the cans. For the first three years there was not even a power winch for hoisting the fish from the boats to the cannery wharf. Fish were hoisted by hand, pulled up in baskets and carried in the same to the tank in the cannery. The pound oval pack which has become the specialty of the Monterey canneries was developed under these normal conditions, and was well established at the outbreak of the war. So here, although but two canneries awaited the great expansion of the industry, they were on a relatively firmer basis, in so far as the sardine was concerned. In 1916, not only were the two existing firms kept busy, but a number of new canneries were started.

The fishing methods.

But, in northern California there had also developed a successful method of fishing, which provided a more uniform and cheaper supply of fish. This successful method was the use of the lampara.*

There has been some controversy as to whether or not fishing before 1905 was done with a gill net, and whether this was carried on during the daylight or at night. Gill netting, at present, is done in a small way for bait and for the fresh fish market, and has been practiced thus for many years at Monterey. So it is possible that during the first year of experimenting the fish were supplied by the gill net fishermen.

However, from 1903 to 1905 a purse net was used for sardines, for the most part in the daytime, usually in the afternoon, but occasionally at night. The fish were located by seeing them jump at the surface or by seeing schools in the shallow water. The cannery (F. E. Booth) furnished the equipment and the fishermen worked by the month for wages.

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*These notes regarding the lampara are those of Mr. W. L. Scofield, who kindly made inquiries regarding the matter at the writer's request.

Instead of the modern lighter the "Sacramento River seine boat" was used. It was a light, double-ended boat, carrying the net and the catch. The seine was circled by hand from the skiffs, pursed from the seine boat or the skiffs, and pulled up between the fishing launch and the seine boat. The catch was dipped out and into the seine boat, about as at present.

The net was made of one-inch mesh, from No. 6 cord, was twelve fathoms deep and two hundred long. There being no "bag," the fish were held by pursing the bottom by means of a rope run through rings. The net was extremely heavy because of the small mesh, and ten men were necessary. Hauls had to be made in shallow water, because the fish were almost sure to be frightened and to sink below the net if the water were deep enough. Fortunately the sardines could be found in shallow water a good part of the year.

As the capacity of the cannery was only about ten tons, but one crew of ten to twelve men under a captain was employed during the first three or four years. The fishermen often failed to obtain a supply, and in 1905, the captain, Pete Ferrante, with Booth's backing, sent to Tangier for a lampara net, essentially similar to the one described elsewhere in this volume. This net had a bag of fine mesh in which the fish were trapped before they could sink, and it was easier to haul because of the coarse mesh in the wings. The purse seine and the lampara were at first used together, one for the day, the other for the night fishing, but in 1906 the purse net was abandoned because more expensive. Other lamparas were patterned after this first one, which soon went to pieces, and of course many modifications have been made since. But the use of the lampara soon enabled the fishermen to catch sardines in deep water and at night, when they could be located by their phosphorescence. The result was a larger and more certain supply. It can not be doubted that the lampara has played a most important part in the establishment of the sardine industry on this coast.

In 1905 or 1906, the lampara was carried on the launch, and a barge substituted for the seine boat. Since then larger and larger launches have been used, with more powerful engines, just as in all other marine fisheries the methods of transportation have been steadily improved. The nets themselves have been deepened to fish more efficiently, and in southern California the type of net which the Japanese fishermen have modified from the lampara is thought by many to be a great advance.

THE WAR PERIOD.

Then, with two canneries packing sardines at Monterey, the tuna canneries awaiting a method of filling in the long winter season in southern California, and the methods of fishing already developed, there occurred the outbreak of the Great War in 1914. It altered the sardine industry on this coast as thoroughly and profoundly as it did any other industry. First, in 1915, the domestic market was abandoned by the foreign packers to our own Maine and California industry, imports dropping sharply and continuously. Then, in 1917 and 1918, the European markets themselves were opened to our products by the derangements of supply, etc., in Europe, while with our entry into the war came the insistent campaign for food conservation, including the eating of fish rather than meat. The effect of foreign conditions upon our imports of "fish packed in oil" and our exports of "canned fish except salmon" is shown in Figure 56, taken from the reports of the Department of Commerce of the United States. This illustrates this point well, since sardines form the bulk of both categories. It will be noted that imports declined in 1915, but that exports did not rise until later.

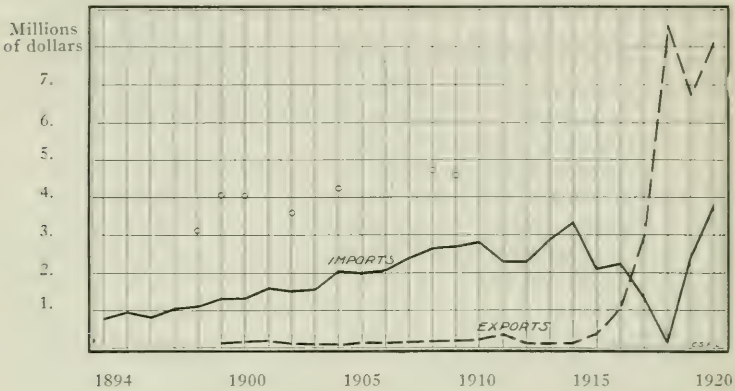

FIG. 56. United States imports and exports, to show condition of foreign trade. Imports of "fish (except shell-fish) packed in oil," and exports of "canned fish except salmon," as given by Monthly Summaries of Foreign Commerce of the United States, issued by Bureau of Commerce. Total value of Maine pack of sardines for various pre-war years shown as circles.

Foreign conditions.

To understand this change, however, the condition of affairs in Europe must be analyzed, and we may briefly review the history of the fisheries at Stavanger, Norway, where the packing of the Norwegian "sardine" is extensively done. In the lower part of Figure 57 are shown the exports to the United States. It is obvious that the fall is entirely parallel to that shown by Figure 56 for the imports into the United States, and that it was a fall of identical character in quantity as well as in value. However, in Figure 57, the middle section shows that the total quantity packed did not fall until a year or perhaps two years later, and that the value of the packed fish did not fall until three years later, namely, in 1917. In other words, the market for Norwegian sardines was found in Europe during the first years of the war, just as trade reports also indicate that better prices were obtainable in the British and German markets than in the United States. This condition prevailed during 1915, and also to an even more marked degree during 1916, a year termed by the Norwegians the "golden year" because of the high prices, and despite the rise in cost of materials and labor. But in 1917 and 1918 the exports to the United States and the total production both fell, because of scarcity of materials such as tin plate, olive oil, fuel oil, the prevalence of labor troubles, influenza and the placing of embargoes by belligerent countries. In 1917, for instance, there was a marked shortage of tin plate, save where the factories supplying goods to Germany were provided with cans by that country. These conditions continued and were intensified during 1918, so that, in contrast to 1916, it was termed a ''dead'' year.

The effect of such changes as they affected the Norwegian canneries is, in passing, of great interest to us, as perhaps such changes as occurred to them may be apparent in the case of our own industry. The first result of the increase in price obtained was the founding of more canneries in 1916, and the later closure of many. Then there was the increased value per unit quantity of fish used, apparently not dependent upon the composition of the catch. Thus in the upper section of Figure 57, the percentage—among the total of herring and sprat—of bristling, or young sprat, which are supposed to provide the best pack of ''sardines,'' is shown by the line of dots and dashes. It is obvious therefrom that the largest part of the war pack was made from the young herring and the blending, or mixture of sprats and herrings, and that not until the very small pack of 1918 did the percentage of bristling rise. And that very promptly fell upon the

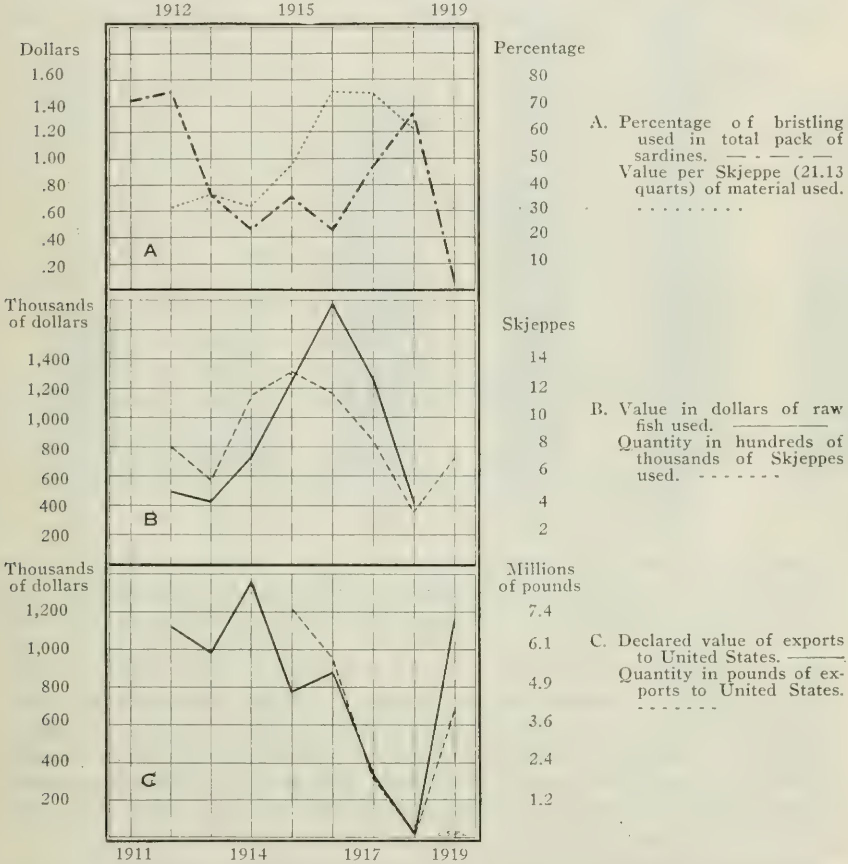

FIG. 57. Condition of sardine fishery at Stavanger, Norway. Data from Supplement to Commerce Reports, Bureau of Foreign and Domestic Commerce.

resumption of packing and export to the United States in 1919. But the value of raw fish per "skjeppe"[*] rose and fell in accordance with the value of the total. In other words, the war market was flooded with the pack of herrings and blanding, while the number of canneries first increased and then diminished.

That some such conditions applied throughout Europe would seem to be true from the fluctuations which occurred in the importations from various countries into the United States. These are shown in Figure 58. With the exception of the imports from Italy, all countries showed a decreased total in 1916, and a near collapse in 1918. Our consular reports show much the same to have occurred in Portugal as in Norway, namely, a first diversion of produce to European markets, then a general slackening of the industry, producing, in so far as imports into the United States were concerned, a nearly continuous fall. We may therefore summarize the causes of the fall in imports and the rise in exports as due to, first, the abandonment of the American market by European packers, and then the collapse of the European industry in part at least. American packers therefore were first offered a better domestic market and then a share in the European market in addition.

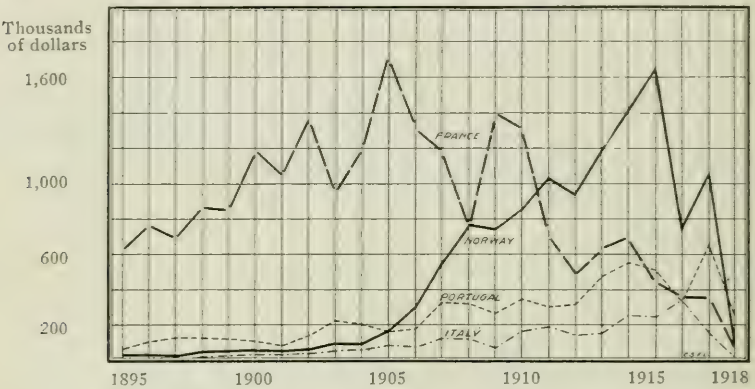

Fig. 58. Imports into the United States of "fish (except shell-fish) packed in oil," from various countries, showing rise of Norwegian and fall of French imports during pre-war period, also fall of all imports during war. Data from Bureau of Foreign Commerce and Navigation of the United States.

The rise of the California industry.

It will be seen that the most favorable conditions existed for our sardine fisheries, and the resultant effect upon the extent of our pack may be seen in Figure 59. Almost all sardines which are taken in this country are packed, and the increase in pack is clearly shown. The first great pack was, it is obvious, in 1917. And this corresponds with the great rise in value of sardines in this country, resultant in part from the conditions we have dealt with above, and in part from war conditions considered more generally in their effect on the domestic markets. At the same time we must remember the great encouragement given to the use of fish during 1917 and 1918 after our entry into the war. In Figure 60, we have shown the rise in value of Maine, Norwegian, Portuguese and French sardines in so far as they were obtainable in the Los Angeles markets, utilizing quotations on cases of a hundred quarter-pound oil sardines. When it is borne in mind that the California sardines were packed to meet the high values of 1917 and 1918, Figure 59 should be clearly understood.

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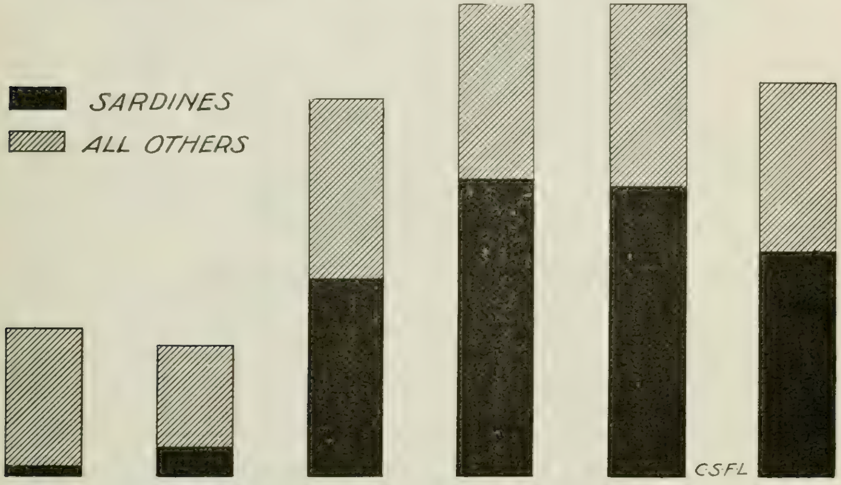
[*] A skjeppe equals 21.13 quarts.



	1915 millions	1916 millions	1917 millions	1918 millions	1919 millions	1920 millions
Sardines	4	16	104	158	154	119
All fish	78	70	200	250	250	208

FIG. 59. Catch of sardines in millions of pounds, compared with catch of all fish in California during war period. Data from reports of California Fish and Game Commission, save for 1915, which is from reports of the Federal Bureau of Fisheries.

The rise in value is shown in Figure 60 on a logarithmic scale, which has the effect of making the rise of each commodity show as it would if reduced to a percentage basis, and the slope of the lines is therefore comparable and truly indicative of the relative rise in value. An increase of a dollar a case of Maine sardines would plainly be a larger proportionate rise than a dollar a case of French sardines, yet the ordinary charts would show the two increases as identical amounts, but the logarithmic chart shows them as considered in relation to the first price, namely, a greater rise for the Maine than for the French in proportion. The figure demonstrates that the Norwegian sardine did not rise as fast as the Portuguese, save for a brief period in 1920, and that the Maine sardine fluctuated in price much as did the Norwegian. In so far as the French sardine is concerned, the sudden rise in price in 1914 and the subsequent practical disappearance we have not been able to analyze. We have no data on the California pack of quarter oil sardines which is comparable to these shown, because such a pack was not placed on the market until 1917. But there are shown the changes in value of Booth's Crescent one-pound oval pack, from

Monterey, and this shows much less relative rise than the others utilized below.

Just as the first flush of war prosperity and high prices in Norway in 1915 and 1916 resulted in the starting of eighteen new canneries, so in California the tuna canneries turned suddenly to sardines and new ones were constructed. To illustrate this point, we have attempted to tabulate the canneries and the time of their construction or diversion to sardine packing, according to the year, with the following results:

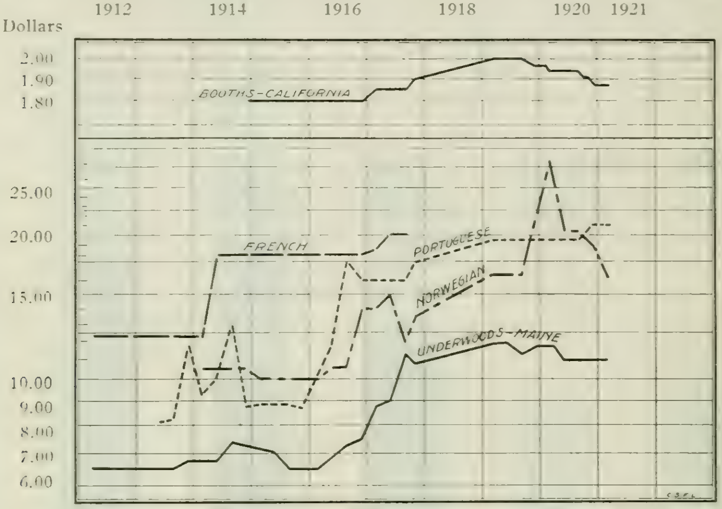


FIG. 60. Fluctuations in wholesale price per case of quarter-pound-oil sardines in Los Angeles during and shortly before the war. Above, price per dozen of Booth's Crescent, pound oval size. Given on logarithmic scale to show relative rather than absolute fluctuations in price. Data from Commercial Bulletin of Los Angeles.

1894— 1 cannery built.
1903— 1 cannery built.
1906— 1 cannery built.
1915— 1 cannery built.
1916—14 canneries start packing, 11 previously tuna.
1917—11 canneries built.
1918—10 canneries built.
1919— 5 canneries built.
1920— 2 canneries built.

Of course, some of these are no longer existent or have ceased operations, but the point we desire to make is obvious, that there was a very considerable increase in canneries due to the value of the canneries, both for Monterey and for southern California, as contrasted with the much more modest rise in the pack produced, especially in southern California. It will be remembered that somewhat the same sequence of events occurred in Maine, when during the early days of the industry the canneries multiplied faster than the pack increased, until consolidation and elimination took place.

But there was another parallel with the Norwegian pack perhaps not less important, although perhaps not due to the same causes. And that was the emphasis upon quantity rather than quality. Previous to the outbreak of the war the pound oval held the field, but for a time the round can cooked inverted and by steam took a very prominent place. Introduced in 1916 by the Van Camp Sea Food Company, and widely adopted, this round can pack proved economical, and large amounts were shipped to Europe. But due to the emphasis upon quantity production its reputation was entirely lost. Other packs were subject to the same criticism, and far-sighted canners and brokers began to insist upon quality, foreseeing the failure of their markets under the more normal conditions sure to return in time. The National Canners' Association was asked to establish an inspection service and in 1917

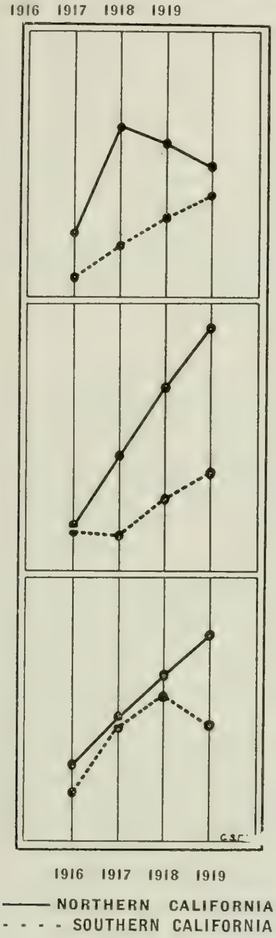


FIG. 61. Comparison of number of cases canned, value of packing plants and number of employees.

ALL FISH CANNED IN CALIFORNIA BY CASES

	Northern	Southern
1916--	196,104	522,609
1917--	480,111	1,538,122
1918--	729,100	1,385,202
1919--	905,206	1,166,435

VALUE OF FISH PACKING PLANTS

	Northern	Southern
1916--	$860,590	$948,702
1917--	786,197	2,573,453
1918--	1,569,330	4,089,660
1919--	2,272,514	5,436,357

NUMBER OF EMPLOYEES IN FISH PACKING PLANTS

	Northern	Southern
1916--	1,573	2,289
1917--	3,090	3,261
1918--	3,829	4,210
1919--	3,123	5,119

this was done, as is related in another part of this issue. Under the stress of our entry into the war, the government for a time put the whole force of its influence back of this inspection service, in addition to a campaign of price fixing. At present the majority of southern California packers belong to it.

By-products.

An interesting part of the war demand was the high prices paid for oil, for fertilizer and for fish meal. Many of the canneries installed plants of their own for handling their offal, producing therefrom oil, and fish meal. But ultimately so much whole fish was diverted to these plants when the profit was greatest that the matter became serious and attracted attention. The California legislature therefore passed a law in 1919 placing the control of the matter in the hands of the Fish and Game Commission. The effect was to decidedly reduce the percentage of fish diverted to this use, but in 1920 the market for such by-products had in part declined so that there was less temptation to utilize fish for that purpose specially.

Competition within the state.

The three canning districts of Monterey, San Pedro and San Diego have to a certain extent competed with each other in the past, and the history of this is interesting, although only brief analysis of this can be made. There existed, previous to the war demand, two successful sardine canneries at Monterey, packing the larger sized sardines so readily obtained there. But the single sardine cannery in the south after intermittent operations finally turned exclusively to tuna packing.

The seemingly superior vitality and success during the prewar period of the Monterey packers may have been due in part to the greater ease of fishing in Monterey Bay, with the resultant cheapness yet excellent condition of the supply of raw fish, and the use of a larger, more economical type of pack than the quarter-pound square cans of the imported brands. It is said that the larger type of pack finds its principal market in such countries as Cuba and the Philippines, as well as the United States. How far foreign sardines are able to compete for this market we have not ascertained. But it may well be that an essential element in the history of the southern and northern packers has been the greater reliance of the former upon goods fitted for export and for competition with foreign brands.

The following table illustrates the differing styles of pack made in northern and southern California, due to the larger fish which prevail at Monterey. It is said that occasionally there is a year when sizes of fish suitable for quarter-oil packs are present at Monterey in numbers sufficient to render them easily caught, but that does not seem to be often enough to establish a quarter-oil pack there:

Sardine Pack in Three Statistical Districts, According to Percentage Packed in Various Sized Cans.

District	Quarter pound, per cent	Half pound, per cent	One pound, per cent
San Diego	55.5	17.9	26.6
San Pedro	16.7	37.8	45.6
Monterey	.8	2.8	96.3

It will be seen from this table that the Monterey district has packed more of the pound sizes, while the San Diego packers have depended very largely on the small sized fish for quarter-pound cans. Whether this will explain the greater steadiness of the price, as shown for Booth's sardines (Monterey) in Figure 60, and of the quantity packed as shown in Figure 62, we do not venture to express a decided opinion.

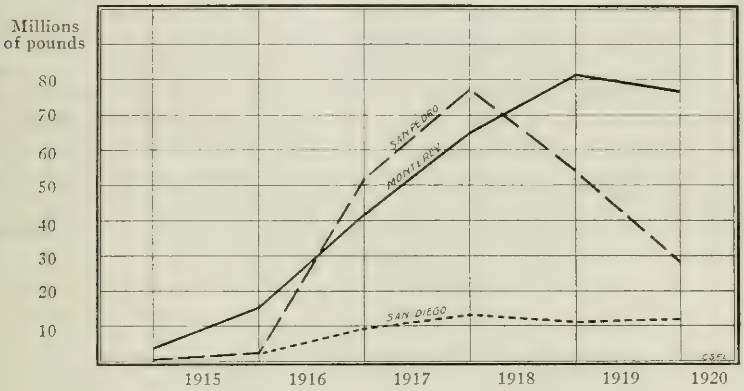


FIG. 62. Catch of sardines in three statistical districts of California. Data from California Fish and Game Commission, save for 1915, which is from Federal Bureau of Fisheries. (Note that pack of San Diego sardines is largely the valuable smaller sizes, and of Monterey of larger sizes.)

(Figure 62 shows the relative amounts packed in the three principal sardine districts of California.) This characteristic of the Monterey pack was shown also in 1915. At all events it would seem that the problem of maintaining the sardine industry in competition with foreign and Maine sardines more largely concerns the southern packers than the northern.*

It will be seen that we have not considered in detail the effect of the Maine sardine pack, as we have not yet material which bears upon the matter. But that the competition from Maine may be serious is easily ascertained from the figures for past production, in so far as we have them. In Figure 56, we have shown the pack value of Maine sardines as isolated circles for those years for which data are available.

Nor have we dealt with the appearance of the sardine, or rather the adult called a pilchard, in British Columbia. The salmon canneries there packed in 1917 a total of $11,810 worth, in 1918, $413,853, and in 1919, $371,871. These were sold as pilchards, according to the

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*NOTE.—In so far as foreign competition is concerned, southern canners have recently expressed considerable concern over the effect of the rate of exchange upon the selling price of Norwegian sardines in this country.

As has been said by an official of a San Pedro corporation, with all foreign exchange at a low level, the tariff on canned fish no longer gives any protection, and Norwegian sardines are being sold to jobbers at $9.75 a case. Pacific Coast canners are compelled to ask $12 a case to pack. The Norwegian canner gets in his own money what is under normal conditions the equivalent of $20.20 for this $9.75.

This is, of course an aftermath which might have been expected from the changes in the rate of exchange, and the low level maintained by the disturbed conditions of Europe. It is one of those evidences of the desirability of restoring conditions in central Europe which are coming to light in increasing numbers.

English style of terminology. It yet remains to be seen whether the run was sporadic or not.

And, finally, we may add that it has not been our intention to in any way indicate an opinion of the future, for there is little of positive value in prophesying. Yet one may surmise that the increase of population in this country would of itself greatly enlarge the markets. From 1900 to 1910 the inhabitants of the United States increased about 21 per cent, while from 1910 to 1920 the increase was about 14 per cent. Yet the consumption of sardines, including the "fish packed in oil" and imported, increased over 40 per cent from 1900 to 1910, taking value as a criterion. The emphasis during the war upon the eating of fish could not help but have benefited the sardine industries. And added to these favorable facts, one may bear in mind the depletion in part of the salmon fisheries, and the general high cost of other foods. Indeed, despite the distinct evidence that war conditions had much to do with the birth of our sardine industry an optimist might find much to comfort him.

FERTILIZER, STOCKFOOD AND OIL FROM SARDINE OFFAL.*

By W. L. Scofield.

Introductory.

Although the fishing industry in California is new and by no means fully developed it is duplicating the experience of older industries and is giving more attention to the development of by-products. Of the hundreds of tons of fish caught in California each year, less than three quarters can be used for human food because over 25 per cent of the weight of fish is inedible. In our leading fishery industry, the canning of sardines, about 50 per cent of the catch goes into cans and roughly 50 per cent of the original weight is discarded as heads, entrails and broken and under sized fish. In mild curing king salmon, about one third of the original weight is lost in head, intestines, and backbone. In the past this great quantity of inedible fish material was thrown away as a complete loss. First in Europe and later in America this discarded material was found to be valuable and its conversion into a usable form proved to be financially profitable. A California sardine packer states that the profit derived from utilizing his sardine offal is sufficient to pay the running expenses of his cannery so that the return from the canning plant is "velvet." Although this case may be exceptional it indicates that the by-products of the industry have already assumed great importance and there is every indication that more and more fish waste will be utilized. There are at present several firms in California that make the utilization of waste fish their only business. A much larger number of reduction plants are operated in connection with fish canneries so that at present California stands well toward the top in the utilization of fish waste. The inedible or waste portion of the fish is now being converted into forms that indirectly serve as human food. Waste fish is reduced to fish meal which serves as food for animals and plants that are used as food by man. In other words we are now eating, directly or indirectly, nearer 100 per cent of the sardine than the former 50 per cent. The discrepancy in this 100 per cent consumption as human food lies in the fact that fish oil, a by-product of fish meal, is used for commercial purposes other than food. The edible oil refined from fish oil has as yet proven unsatisfactory although there is constant experimenting at present and a palatable salad oil may result.

Uses of fish meal and oil.

Fish waste was first dried and ground into fish meal to be used as a fertilizer for plants and its value as fertilizer has long been recognized. There was in the past a prejudice against using the meal for stock food because the oil in the meal was said to impart a fishy flavor to the flesh of the animal eating the meal. This has been overcome by extracting the oil from the meal before feeding it to stock. In fact the oil has been found to be so valuable that the cost of extracting it is unimportant compared with its sale value. Fish meal, by experiment and tests on a large commercial scale, has been found to be exceedingly valuable as a stock food, equaling and exceeding tankage and grains as an animal food. Fish meal is now in demand as a food for swine and cattle but the largest demand is as a chicken food. Chicken raisers claim that fish meal has been found to be far superior to any other meaty food, as meat scraps or blood. Its value lies in its high percentage of protein, or more properly speaking, in its high nitrogen content in the form of ammonia and in phosphoric acid as bone phosphate. These are also the elements so much valued in fertilizers and fish meal now competes with the high grade nitrogen materials (as ammonium sulphate) and the cheap bone phosphates in commercial fertilizers. The chief demand in this state for the meal as a fertilizer comes from the fruit growers, especially the orange growers. The meal therefore has two chief uses, as stock food and as fertilizer. So far, the high price of the meal has largely confined its use to the more intensive growing of oranges and chickens and most of the sales are made to orchardists of southern California and to the Petaluma chicken raisers. Meal sold in the open market brings about the same price when sold either for fertilizer or for chicken food.

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*California State Fisheries Laboratory, No. 32.

Sardine oil (as well as other fish oils) is used extensively in the leather tanning industry but the chief use of the clear oil is in the making of paint and the heavier fatty materials are used in the manufacture of soap.

Reduction process in general.

Fish contain a high percentage of oily fat, varying from 5 to 20 per cent in fresh sardines. This oil is not only valuable for other uses but it is a detriment in a stock food or fertilizer. The oil and fat are therefore extracted before the fish material is marketed as a fish meal. There are two general methods of removing oils from either vegetable or animal material. When the oil is to be used for human food it is usually pressed out. Oil to be used for commercial purposes other than as human food, is frequently removed by the use of a volatile solvent which takes up the oil. The solvent may then be volatilized and the oil recovered. The first fish reduction plants used the pressing method and this principle is still the one commonly used in the fish reduction plants of California. At present there are in the state but two plants using the volatile solvent method of extracting fish oil. This method will be described later. The usual practice (press method) is to cook the fish material sufficiently to loosen the flesh from the bones and break up the fish skeleton. The oil is then pressed out and later refined. The meal is then dried, cooled, and run through a grinder to break up bony particles. The meal is then sacked ready for shipment. There are minor variations in the application of the press method but the chief differences between plants are in the method of drying the meal rather than in the manner of pressing out the oil. One of the variations in method of drying will be described later. In order to give a more consecutive idea of the different steps in the reduction of fish to meal, it will be helpful to consider a description of a typical plant using the common press method for sardine offal.

A typical plant of the press type.

The plant selected for description as a typical fish reduction plant, is one operated in conjunction with a Monterey sardine cannery. The reduction plant normally receives 30 tons of sardine offal per day, although it is capable of handling much larger amounts if operated continuously through the day. The fish material is almost entirely sardine offal from the cutting tables of the cannery with the broken and under sized whole fish that naturally result from canning operations. The offal from the cannery is collected in a large storage bin from which a belt and bucket conveyor transports it to the top floor of the reduction plant building. The offal is about 45 minutes in passing through the plant from this storage bin to the drying floor as finished meal, but only a small amount may be run through at a time. Therefore the belt conveyor from the bin has small buckets that feed in only the proper amount of offal.

Cooker.

The older plants of Europe used to cook the fish in vats over a wood or coal fire but steam cooking is the common method now used in California. The cooking is done in a steam chamber or stationary horizontal cylinder roughly two and a half feet in diameter by 18 feet long and insulated with asbestos packing to conserve the heat. Offal is carried through this steam chamber at a uniform speed by means of a revolving auger action conveyor shaft whose revolutions are so timed that the fish remains in the chamber about 15 minutes. This revolving conveyor carries the cooked fish to the press.

Press.

The common form of press used in this state is a horizontal continuous screw press said to be a modification of the French olive press. The press is an auger shaped screw working into a metal jacket which is perforated with openings about the size of a pin hole to allow the water and oil to escape. The screw press is about seven feet long. The first three feet of the press casing or jacket is of lighter construction, with relatively larger holes for the purpose of draining off the free water. In the last four feet, or press proper, there is another screw revolving more slowly, and the distance between the auger flanges is reduced so that the material moves forward more slowly. This slowly revolving screw works against a deeply beveled stationary disk which blocks the forward progress of the material and allows it to escape very slowly in the form of a coarse paste scraped from the beveled edges of the disk. The escaping oil and water are caught in a drip pan and piped to tanks.

Dryer.

The pressed material, now in the form of a paste-like mass, must be dried to prevent moulding and souring. Drying is done by hot air. In this particular plant the drying is done by passing the fish through two horizontal stationary drums or cylindrical chambers each 30 feet long. A circulation of hot air from the furnace is forced through these drums or "dryers" by means of a rotary blower. A vent up the smokestack, provided with rotary section fan, carries off the moist air.

The fish paste drops from the end of the press into an auger conveyor and is carried through the first dryer. It then drops to the second reversed conveyor and passes back through the second drum, which is situated directly under the first. The material is now in the form of a somewhat moist, steaming hot meal. From the end of the dryer the meal enters a piped cold air blast which serves primarily in cooling the meal, but also transports it to the grinder. The press and the dryer break up the fish very thoroughly so that very little grinding is necessary except for occasional bones. The meal passes through a small motor driven grinder and drops on the floor where it is spread out for two or three days to complete the cooling process and to dry out more completely. It is usually shoveled over two or three times on the floor before being sacked in 90-pound sacks for shipment.

Oil recovery.

The oil and water which drain from the press are separated by gravity. The drippings from the press are run through a series of five settling tanks. In the first tank the water and refuse particles are allowed to settle to the bottom and are drained off into the ocean. The oil is syphoned over into the next tank in the series where the gravity separation of the fat from the oil is begun. The top or first oil in the last settling tank is a fairly clear oil but the complete clarifying of the oil by settling out the fat may require several weeks and is unnecessary. The clear oil from the top of the last tank has been used successfully as a paint oil without further refining or the use of a drier in the paint, but this is not the usual practice. The oil is shipped in barrels to paint factories where it is processed for use in paints. This fish oil sells for about one-third the price of linseed oil.

Below the clear oil in the tanks is found the cloudy fatty oils and thick fat material called stearine. The heavier stearine is called "foots." The stearine is sold for use in the manufacture of soap. As stearine contains from 40 per cent to 50 per cent oil it is sometimes heated and more oil drawn off but it usually goes direct to the soap manufacturer.

A modification of the press type.

In the typical plant already described, the fish material, after cooking and pressing, was dried by being carried through stationary drums through which was forced a circulation of hot air from the furnace, by means of rotary blowers. We will consider briefly a plant in which a very different form of dryer is used. In this case the dryer is a revolving drum without a conveyor through the center. A cylindrical drum (five and a half feet in diameter and forty feet long) is placed on a slight decline from the press (pitch of one-half inch to the foot). The hot air is provided by a blast of burning mixture of oil and steam in a firebox so arranged that the flame blast strikes a lattice work of brick allowing only the heated air to enter the drum. A direct flame is not introduced into the drum for fear of scorching the fish. At the opposite end of the drum the necessary air suction is provided by a tall smokestack (four feet in diameter and 60 feet high). On the sides of the drum are a few longitudinal cleats or "channel irons" which serve to tumble the fish material as the drum is rotated. The strong draught of air and the pitch of the drum from the horizontal, serve to carry the fish waste forward as it dries out. The heavier particles of the dried material tumble out of the back end of the dryer and are caught and conveyed away by a large cold air suction pipe. There are about 200 feet of this air pipe with two rotary blowers so that the material is not only cooled, but is further broken up into fine meal. To prevent the lighter particles from passing up the smokestack, there is a series of three catching, or dust chambers, the operation of which will be described later when considering the volatile solvent method. The meal from the cooling pipes is spread on the floor for several hours for further cooling and is then sacked without grinding. The pressing and tumbling in the dryer and conveyor pipes reduce the material to a fine meal containing only a few bones that have not been completely broken up. In this form the meal is ready for use as fertilizer but it should be ground before used as a chicken food.

Anchovies difficult to press.

It frequently happens that a sardine catch contains a large percentage of anchovies, especially when small sardines are being taken. This is an important consideration because the ordinary screw press will not operate properly with a high percentage of anchovies, especially when the anchovies have been more than eight or ten hours out of water. The soft anchovies churn up in the press as a jelly-like mass that will not feed out and clogs the oil holes and the screw of the press. Anchovies may be used when mixed with sardine offal to lend more body to the material and thus pass it through the press. It is claimed that a mixture of half anchovies and half sardine offal will press fairly well but a lower percentage of anchovies is preferable.

Yield in meal by press method.

The solid flesh of the whole fish yields more meal than a like weight of offal, so that the percentage of whole fish in the offal effects the amount of meal recovered. The degree of fatness of the fish also affects the yield of meal since there is relatively more oil in a ton of offal from fat fish, but there is far less variation in the amount of meal than in the amount of oil recovered. In the typical plant already described the number of tons of sardine offal necessary to make one ton of fish meal varies from five and a half to seven and a half, with six tons as the probable average. The weight of the recovered meal is roughly estimated at one-sixth that of the offal in this plant. Other plants with somewhat different methods estimate the meal at one-fifth to one-fourth the weight of the offal. The remaining five-sixths of the weight is partially recovered as oil and stearine but most of it is water of which the greater per cent is driven off by evaporation. The water content of fresh sardines is high (probably 60 to 75 per cent) and canned sardines are about 60 per cent water but a low moisture content is desirable in both fish meal and oil. The meal contains less than 10 per cent moisture and the oil less than 2 per cent water.

Composition of meal by press method.

Fish meal sells on its chemical composition and frequent samples are subjected to chemical analysis. The chief value of fish meal lies in its nitrogen and phosphoric acid content. The nitrogen as ammonia is the most important element and the price of a fish meal on the open market is largely determined by the percentage of ammonia present. The ammonia content varies between 8 and 14 per cent, but a high grade meal usually has between 10 and 12 per cent ammonia. The phosphoric acid content as bone phosphate is the next most important consideration in fixing the price. A low moisture content is desirable as the buyer does not care to pay for useless weight in water. The water content is not run below 6 or 8 per cent, not only because of the cost of further reducing the per cent, but also because the sacked meal will absorb sufficient moisture from the atmosphere to bring it up to 6 or 8 per cent. The moisture content of meal varies from 8 to 13 per cent but is usually about 10 per cent. The pressing method does not extract all of the fish oil from the offal and the resulting meal from this process contains from 7 to 10 per cent of oil (ether extract). The chemist's analysis of the meal produced by the typical plant we have considered gives the following results expressed roughly:

Nitrogen	9 to 10 per cent
Phosphoric acid	5 to 10 per cent
Nitrogen as ammonia	10 to 14 per cent
Phosphoric acid as bone phosphate	10 to 22 per cent
Moisture	9 to 12 per cent
Oil (ether extract)	8 to 10 per cent

The term protein is often used in the analyses of meal to include the proteids or nitrogenous matter of the soft tissues of the fish body. Such classifications divide fish meal into protein, oil or fat (ether extract), water and mineral ash. In such cases the protein content ranges from 50 to 60 per cent, a much greater percentage than in fresh fish with its higher moisture content. A rough rule of thumb sometimes followed when the nitrogen content of the meal is given, is to multiply the percent of nitrogen by 5.25 to give the protein content. In judging a fish meal it is essential to know the percentage of (1) ammonia, (2) phosphoric acid, (3) moisture, and (4) oil (given in the order of their importance).

Yield of oil by press method.

In sardines there is a great deal of oil in the flesh just back of the head but the fat about the entrails and the liver itself is especially rich in oil. In cutting sardines for canning, the fish is cut in two near the back of the body cavity and only the posterior half of the fish is canned. Thus the head and entrails are discarded as offal. Therefore a ton of offal will yield more oil than a ton of whole fish and the per cent of whole fish in the material will affect the yield of oil. The greatest source of variation is the periodic fluctuations in the fat content of the sardines themselves. At some seasons of the year they are very fat with a high oil content, while at other seasons, especially in the spring, the fish are thin and have relatively little fat and oil in their bodies. The fat content of sardines varies roughly from 5 to 20 per cent. As anchovies have much less oil than sardines a quantity of anchovies mixed in the offal reduces the oil yield per ton of material. For the above mentioned reasons the yield of oil varies greatly from day to day and from month to month. In the typical plant we are considering, the oil yield varies from 7 to 27 gallons per ton of offal, with a rough average yield of 10 to 12 gallons of oil and fatty material (stearine) per ton of offal.

Composition of oil by press method.

Fish oil, like fish meal, sells on its chemical analysis. The oil with a small per cent of free fatty acids or unusable material is the high-grade oil bringing the best price. The impurities are referred to in the trade as free fatty acids and M. I. U. The M. is moisture and other volatile matter, the I. is insoluble impurities and the U. is unusable or unsaponifiable matter. The amount of impurities in an oil varies naturally with the method and care used in the refining or settling process. As more care is now being given to this phase of the subject, some of the west coast oils are finding ready sale locally and in the Eastern States. In the past the lack of care in refining and looseness in grading the oil has caused much of the west coast oil to be classed as inferior grade and accepted at a poor price by eastern buyers. For years the Newfoundland and American cod oils were the favorites till salmon oil was found to be equally good. The whale oil business, having been so long established, now has definitely established grades. The sardine oil, being new from this coast, has not yet come fully into its own. The use to which the oil is to be put largely determines the purity of oil necessary. A leading dealer in fish oils makes the general statement that fish oil for use in paints should not have over 5 per cent free fatty acids and not over 2 per cent M. I. U. For tanning purposes the oil should be from 5 to 7 per cent acids and 1 per cent M. I. U., but clear settled (tanked) oil for use in the better grades of soap should not exceed 3 per cent acids and 2 per cent M. I. U. For a No. 1 grade of sardine oil the limit of impurities is usually set at 2 per cent free fatty acids and 2 per cent M. I. U. The press method, with proper care in operating the settling tanks, yields a sardine oil low in acid content and well within the limit as to other impurities. The chemical analyses of the sardine oil produced by such a plant show the following results:

Free fatty acids	.5 to 1.5 per cent
Moisture and volatile matter	.1 to .7 per cent
Insoluble impurities	a trace to .03 per cent
Unsaponifiable matter	.2 to .9 per cent

Volatile solvent method.

In this method there is no press, the oil being recovered by the use of gasoline as a volatile solvent. The elimination of the press permits of the reduction to meal of almost any kind of fish material without readjustment of machinery or extra labor. Fish scraps, trimmings from the fish and abalone markets, offal, meat scraps, whole fish, sharks, squid and anchovies are reduced with equal facility. In the two California plants there is no separate cooking cylinder, but the cooking and drying are combined in one machine. In the press method the oil and water are pressed out and the material then dried. In the gasoline process the material is dried to eliminate the water and later the oil is extracted from the dried meal. The two gasoline plants of this state are not connected with a fish cannery, but are operated as an independent business, purchasing the raw material from other firms. One plant uses mostly fish scraps and the other, located in one of the sardine canning centers, operates on sardine offal purchased from the canneries. A brief description of the latter plant will better illustrate the method. This plant has a capacity of about 35 tons of offal per day when employing five or six men. With seven or eight workmen the capacity can be increased to 50 or 60 tons per day. The sardine offal is transported to the plant by auto truck and dumped into a storage bin from which a belt conveyor with small buckets carries the material to the dryer. The conveyor is filled by hand so that the amount fed in may be varied according to the directions given by the man operating the dryer.

Dryer.

The dryer (cooker and dryer combined) is a large revolving horizontal cylinder, 40 feet long and 4 feet in diameter, operating on the same general principle as the dryer described above, under "Modification of the Press Type of Plant" which merely dried the cooked and pressed material. This dryer first cooks and then dries the fresh offal from the storage bin. The heat is provided by a burning spray blast of mixed steam and oil, the draught being created by a tall stack. In this case the flame is shot directly into the dryer. The conveyor empties the offal directly into this flame and the four or five longitudinal cleats of the revolving dryer keep it tumbling. The amount of flame and heat may be delicately regulated by adjusting the amount of oil and steam sprayed in. When fairly dry material is being received, the flames extend only two or three feet into the cylinder, but with particularly wet material the flames may be shot into the dryer a distance of eight or ten feet. The wet offal is tumbled in the flame during several revolutions of the cylinder till the material is sufficiently heated to cook the flesh free from the bones. As the moisture is absorbed by the hot air blast and the flames, the dried fish material, being lighter in weight, is blown toward the back end of the dryer. The cylinder is set up with only a very slight pitch downward, the draught being sufficient to carry the fish through. The fish remains in the dryer about thirty minutes from the time of entering the flames till it is blown to the back end of the cylinder as dry meal. The offal is not only cooked and dried in the cylinder, but the tumbling of the dried material breaks it up into a coarse meal, the chunks of which are usually no larger than a pea. In this drying process it is essential that the supply of material being fed into the dryer be uniform, in order to reduce as much as possible the readjusting of the flame. When a great amount of wet fish is fed in rapidly, the drying is not complete and the product is too moist. If the supply of raw material is reduced suddenly, or is much dryer than the preceding supply, the excessive heat burns the fish into hard cakes and extracts free oil, which collects in the bottom of the cylinder and sometimes catches on fire.

Recovery of meal from dryer.

As the back end of the cylinder is open, the meal is blown out into a small catching passage way which has a small hole in the floor to allow the heavier particles of the meal to escape, but much of the meal is in the form of dust and is carried past this opening by the air current. In order to recover this dust, the air current is led through three dust chambers before it escapes up the stack. The opening into the first chamber is near the top and the outlet near the floor, so that the heavier dust settles to the floor. In the second dust chamber the intake is near the floor and the outlet near the top, so that the finer dust settles in this second chamber. The air current then drops again in a third chamber before escaping up the stack, so that all but a negligible amount of very fine dust is recovered. The dust chambers are emptied once or twice a day by opening a door in the side wall and shoveling up the accumulated fine meal. The dried meal is known as "unfinished stuff," as it has yet to be processed to remove the oil. This unfinished stuff is spread on the concrete floor to cool before it is elevated to the second story of the building in readiness for the next step in the process, the extraction of the oil.

Extraction tank.

The extraction tank is a heavy cylindrical steel tank about nine feet in diameter and about fourteen feet high. The tank is filled through a door in the top to within eighteen inches of the top with the dry unfinished meal. Gasoline is then sprayed in from the top through a perforated pipe till the tank is filled with gasoline sufficient to cover the meal. The tank full of meal and gasoline is then heated by introducing steam at the top of the tank. The heat is said to be about 325 degrees and is continuous for an average of about eight hours. The gasoline begins to take up the oil of the fish meal even before the meal is thoroughly heated, so that the process of draining off the mixed gasoline and oil is begun soon after the steam is introduced. The bottom of the tank is a sheet of steel perforated to allow liquid to drain through it. Under this metal sheet there are alternating layers of charcoal and gunny sacking to catch and hold particles of meal, so that the liquid may be drained off as pure as possible. After this oily gasoline is drained out, the tank is again flushed with a fresh supply of gasoline, which is also drained off. A small door in the side of the tank, even with the metal floor, is then opened and the meal pulled out.

Screening.

The meal that has been removed from the extraction tank is then screened or sifted to remove any of the larger particles that have not been broken up by the process so far. The sifted meal is then ready for sacking. The screenings or tailings consist of pieces of backbone, bones of the skull, especially the cheek plates or opercles, small hard lumps formed by a portion of the intestine, and a few chunks of meal that remain packed or were burned somewhat in the dryer. These tailings may be ground up and resifted, or, as is frequently done, may be run through the dryer again, which breaks up most of the chunks and saves grinding so much material. The tailings, after being ground up into fine particles, are mixed with the sifted meal and sacked. It is essential that the meal be quite dry before sacking. If there is much moisture, the meal will mould and heat in the sack. In case the final meal is found to be too moist, it is run through the dryer again before sacking. The sacked meal should not have much over 10 per cent moisture.

Recovery of oil.

The liquid drained from the extraction tank is carried by pipe into a smaller tank called the evaporating tank, which is about 12 feet long and 5 feet in diameter. It is provided with a large steam coil capable of heating the liquid to 300 or 325 degrees. The heat volatilizes the gasoline and a pipe at the top of the tank carries off the gas thus formed. After about four hours practically all the gasoline is driven off, leaving only the fish oil remaining in the tank. If much gasoline is left in the oil and the oil is later refined, a serious explosion is apt to result, so that it is essential to drive off all the gasoline possible. The oil is then blown out of the tank by steam pressure and conducted by pipe to a storage tank. The oil is later deodorized by heating to about 600 degrees, which also removes practically all of the moisture and other volatile impurities. The oil is then ready for shipment to the paint manufacturer.

Recovery of gasoline.

The volatilized gasoline escapes from the evaporating tank in a pipe that is run through a condenser or coiled pipe in a bath of running cold water. Ocean water is particularly good for cooling the condenser pipe. The condensed gasoline drains into a storage tank and is ready for use again in the extraction tank. This distilled gasoline is referred to as "high power gas" because of its greater strength in taking up fish oil in the extraction tank. The high power gas has been freed from many impurities and is much more volatile than ordinary commercial gasoline. In fact the commercial gasoline is usually run through the evaporating process to refine it before it is used in the extraction tank.

Composition of meal.

The meal resulting from the gasoline method has practically the same moisture, phosphoric acid, bone phosphate, nitrogen and ammonia content as in the press method. The meal has about 10 per cent each of nitrogen and moisture. The phosphoric acid content is 7 to 8 per cent and the bone phosphate is in the neighborhood of 16 per cent, although quite variable. The ammonia content is 8 to 12 per cent. The chief difference in the two meals is in the oil content. The volatile solvent method removes more of the oil than the press. The final meal by the gasoline method has about 3 per cent of oil as contrasted with 8 to 10 per cent of oil by the press method. Therefore the oil yield per ton of offal is higher by this method than by the press method, the yield being about 20 gallons per ton of offal. The yield of meal is said to be about 23 per cent of the weight of the offal. This yield is as good or better than the percentage of meal recovered from pressing. Practically all of the meal from this plant is sold for chicken food and is shipped to Petaluma.

Quality of oil by gasoline method.

By the gasoline extraction process the resulting oil, although relatively of greater quantity, is not the high quality oil obtained by methods of pressing. When the fish first enters the dryer and is tumbled in the flame blast, the oil in the fish is sufficiently scorched so that the resulting oil is black or dark brown, and up to the present time has not been refined to a clear oil. For this reason its use is almost entirely confined to the manufacture of paints, where its color is no drawback except that it is unfit for use in white paint. This dark oil seems to give good satisfaction in colored paints, other than white, even in cream colored paint. The recovered oil has very little of the heavy fatty materials as foots or stearine. So little saponifiable material is recovered that it does not, at present, pay to separate it for sale to the soap manufacturers.

The following are a few of the many bulletins published by the U. S. Department of Agriculture, and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.:

Bull. 378. Fish Meal: Its use as a Stock and Poultry Food. (1916.) 5 cents.
Bull. 150. Utilization of Fish Waste on the Pacific Coast. (1915.) 15 cents.
Bull. 2. Fish Scrap Fertilizer Industry of the Atlantic Coast. (1913.) 10 cents.
Bull. 635. Commercial Freezing and Storing of Fish. (1918.)
Bull. 908. Maine Sardine Industry. (1921.) 50 cents.

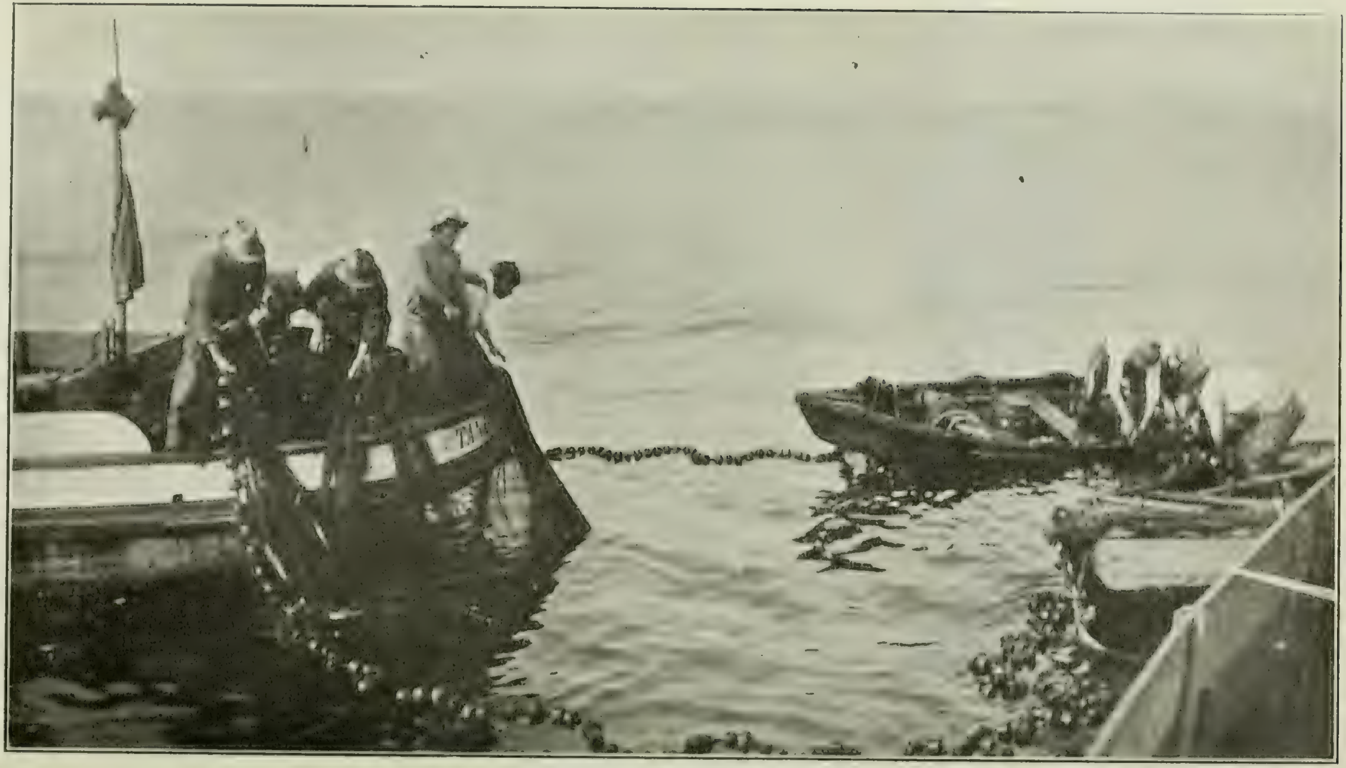

FIG. 63. Hauling in a sardine net. The wings have been hauled in and the lead line raised, impounding the fish in the bunt of the net. Photograph by Messrs. Higgins and Holmes.

METHODS OF SARDINE FISHING IN SOUTHERN CALIFORNIA.*

By Elmer Higgins and Harlan B. Holmes.

It is a fixed purpose of the California Fish and Game Commission to maintain a system of fishery statistics so complete and so continuous that the varied and changing conditions of the fishing industry may be compared year by year in order to determine its actual condition and future prospects. As a partial supplement to the statistical records ot the catch, collected and compiled according to law, these notes on methods and practices are prepared to aid the investigator in future years to reconstruct in his mind the actual conditions in 1921, enabling him to understand and interpret the figures of the catch.

LOCAL CONDITIONS AND GEAR.

Local conditions have their natural effects upon methods and gear, producing in southern California an industry unique in many ways. The sardine fishery is not an independent industry, for the fisherman engaging in it spends fully half of the year fishing for albacore, tuna, sea bass, mackerel, halibut, or rock cod, and hence his boat and gear are modified to meet the requirements of these other fisheries. By far the greater number of boats fishing sardines are typical albacore boats which are converted for use during the winter sardine season by the removal of bait-boxes and poles. Many, however, of a different type, were built before the albacore fishery became so profitable, and are used, during the off season for sardines, in fishing with trammel nets for halibut, or with set lines for rock cod. These two distinct types of boats are manned, respectively, by the two nationalities which dominate the fishery, the Japanese and the Italians.

Weather conditions also have influenced the type of boats used. Although the boats are perfectly seaworthy and capable of traveling several hundred miles, the uniform character of winds and absence of sudden storms has permitted the development of a type of fishing boat poorly adapted to a short choppy sea, being long and narrow and having a wedge-shaped bow with little flare.

THE LOCATION OF THE FISHERY.

The California sardine, *Sardina caerulea* (Girard), occurs in considerable abundance along the entire west coast of the United States, including Alaska and British Columbia, and southward on the coast of Lower California, but the chief centers of the fishery are Monterey, San Pedro, and San Diego. In southern California sardine canneries are located at San Pedro, Wilmington, Long Beach, Newport Beach, and San Diego, the areas fished covering a radius of fifty miles or so from these points. In the San Pedro district, deep water fishing off a rocky coast is found from Point Firmin north to Redondo and off sandy beaches from Point Firmin south to Newport. At San Diego similar conditions are found to the north, about La Jolla, or from Point Loma south to the Mexican border. The winter sardine fishery is chiefly in deep water two to ten miles from shore, but in the summer, fish are caught inshore near the sandy beaches.

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*California State Fisheries Laboratory, Contribution No. 33.

FISHING SEASON.

The sardine canning industry, which utilizes practically the entire catch in the San Pedro district, depends a great deal upon the large fish 20 to 30 centimeters long, known as "pound-oval" size, from the cans in which they are packed. The fish approach the coast in December and are taken in great quantities until April or May, when smaller sizes become relatively more numerous, but canning sometimes starts early in November, utilizing the smaller sizes of sardines known to the trade as "quarter-oils." (Fig. 64.) The same sizes are taken at San Diego, but a larger proportion of the pack consists of the smaller fish, and the season is therefore somewhat extended.

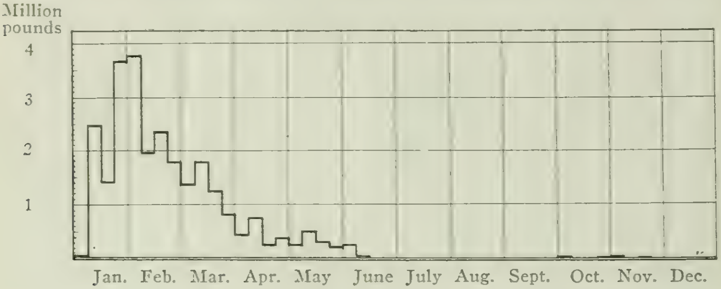

FIG. 64. The 1920 sardine season at San Pedro as shown by the Commission's reports of amounts of sardines received weekly at the canneries.

A summer sardine fishery, scarcely less important economically than the winter fishery, although yielding no statistical record and having no money value, is pursued from Santa Barbara to San Diego. It is the bait fishery, an essential factor in the summer albacore industry. Small sardines of "quarter-oil" size or smaller are highly prized by the albacore fishermen as live bait, and one-half to three-quarters of a ton per boat are taken in the morning whenever possible off sandy beaches before proceeding to the albacore fishing grounds. It is true that anchovies serve as a substitute, but they are not as desirable nor as much sought after as are the small sardines. This bait fishery continues throughout the albacore season, *i. e.*, from June to October. Modified sardine nets called "bait nets" are used and will be described later.

TYPES OF GEAR.

Boats.

As mentioned above, there are two chief types of boats employed in the sardine fishery: one operated by the Italians and the other by the Japanese. Americans (native born), Scandinavians, and Austrians also engage in sardine fishing, but only in small numbers,* and they use boats which may be classed with one or the other chief types.

The Italians were probably the first sardine fishermen on the coast to use the present style of round-haul nets, and introduced their methods and gear from Italy. Their boats reflect an adaptation to trammel-net or set-line fishing after the sardine season, being smaller than the Japanese boats and having less power and speed.

A typical Italian sardine boat (Figures 65 and 66), carrying a crew of five or six men, is 35 feet long, of 10-foot beam, and 4-foot draft, with a wedge bow and fantail stern. A 20-foot mast is stepped in near the bow, and a low trunk cabin runs aft from this half the length of the deck. The space below is occupied by a two- or three-cylinder distillate engine of 20 to 30 horsepower and sleeping quarters for four. In the afterdeck is a hatch opening into a hold where nets or gear are stored

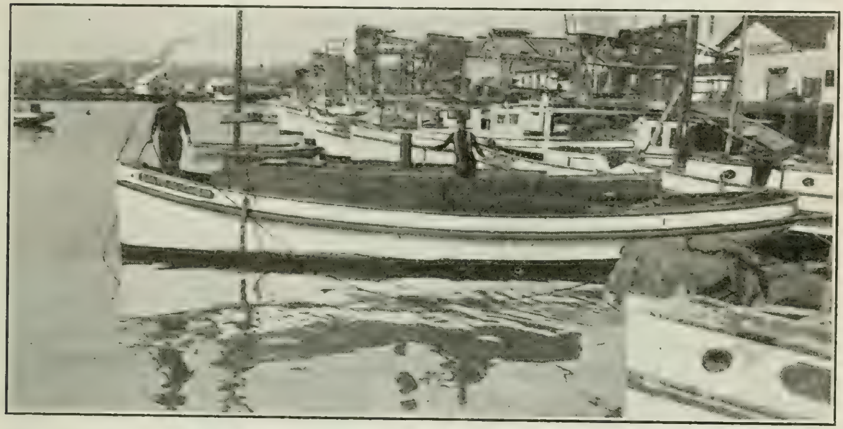

FIG. 65. A typical Italian sardine boat. These boats are also used for fishing halibut with trammel nets and barracuda with gill nets.

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*The following table gives the nationality of fishermen in southern California, as compiled by the Commercial Fisheries offices of the Commission at San Pedro and San Diego from fishing licenses issued for 1920-21:

Nativity	Aliens	Citizens	First papers	Total	Per cent of total fishermen
Japan	1,025			1,025	42
Austria	357	31	104	492	20
United States		328		328	13
Italy	257	9	15	281	12
Dalmatia	66	5	13	84	3
Scandinavia	51	17	13	81	3
Balkan States	22	4	8	34	1
Russia	16	4	1	21	1
All others (10)	78	15	5	101	4
Total	1,872	423	159	2,447	99
Per cent of total	76	17	6	99	

Austrian fishermen engage almost entirely in purse-seining for tuna, barracuda, and sea bass, while native Americans and many Japanese fish chiefly in the summer for albacore. This leaves the Japanese and Italians dominant in the sardine fishery.

and where rock cod or halibut may be iced or stored fresh, when set-line or trammel-net fishing. The operator stands in the open cabin hatchway amidship, his hands on a small steering wheel inside the cabin and his feet operating the controls of the engine. On some boats a movable box-like hood with glass windows in its sides is placed over the open hatch to protect the head and shoulders of the operator from the weather. The speed of such boats is from six to eight miles per hour and they are relatively economical in operation. Their small size, however, reduces the capacity and their speed limits the radius of operation in the sardine fishery. It also unfits them for the more strenuous duty of catching albacore.

The Japanese type of sardine boat is a modification of the earlier market fishing boat and is built primarily for the catching of albacore. It is longer, speedier, and more powerful than the Italian boats, and more comfort is provided for the operator by building an enclosed pilot house amidship. It is thus adapted to traveling greater distances in search of schools and returning with the catch in less time.

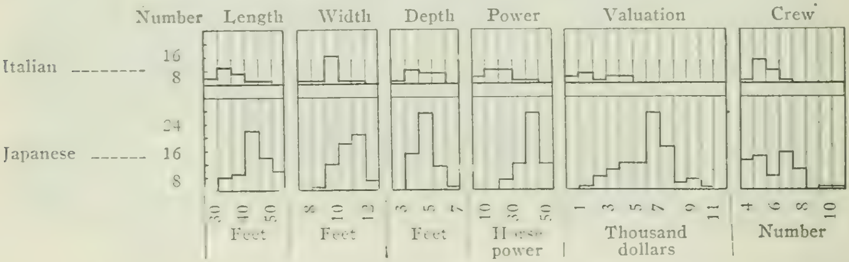

FIG. 66. A comparison of Italian and Japanese types of sardine boats at San Pedro, 1920–21. Data from boat registration records.

A typical Japanese sardine boat (Figures 66 and 73), carrying a crew of seven or eight men, is 45 to 50 feet long, of 12-foot beam, 5-foot draft, and powered with a three-cylinder distillate or crude-oil engine of 40 horsepower, which drives the boat at a speed of from 9 to 12 miles per hour. The vertical bow is wedge-shaped and the stern of fantail type, but broad and rather square. A low trunk cabin with a hatchway on the side runs from near the bow to the pilot house amidship, which is placed directly over the engine. The controls are arranged in the pilot house so that one man operates the boat. The forward cabin is small, having bunk space for two or three men, but extra bunks are fitted in the hold beneath the afterdeck and may be reached through a raised hatch just aft of the cowl or extended roof of the pilot house. A take-down mast set at the forward end of the cabin is carried in a horizontal position, one end resting on the pilot house. The catch of fish is piled all over the afterdeck and along the sides of the cabin as far forward as necessary, and is confined by side-boards which may be built up on the gunwales three or four feet high, according to the size of the load. A space about six feet wide and running athwartship is reserved in the stern of the boat for piling the net and for standing when paying it out or hauling it in again. The fish are kept out of this area by a low transverse bulkhead or partition which may be built up in the same way as are the sideboards. In the center of this bulkhead is erected a standard bearing an electric light on a swinging arm to light the deck for night hauling.

This is the newer type of boat representing three-fourths of the fishing craft in southern California, and is now being built for fishermen of all nationalities, Japanese and Italians alike, for use in the albacore and sardine industry.

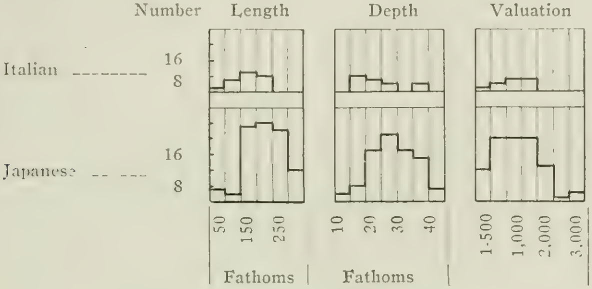

FIG. 67. A comparison of Italian and Japanese types of sardine nets at San Pedro, 1920–21. Data from boat registration records.

Nets.

Sardines are caught entirely in huge nets laid out in circles and hence called "round-haul" nets. Italian and Japanese nets are alike in principle and general plan, but differ in details of design as completely as do the types of boats (Figure 67). Any round-haul net is made in three sections; a right wing, a left wing, and a bunt or bag. The wings are long strips of large meshed net attached at each side of the bunt and are used to encircle the fish and drive them into the bag. The bag is the sacklike center portion of the net, made of fine meshed webbing and used to hold the fish until they may be landed on the boat. The webbing of wings and bunt is fastened to a light rope called the "cork line," buoyed with numerous corks so that the whole net floats in the water with the cork line on the surface. The lower edge of the net is fastened to a similar line—the "lead line"—weighted with leads at frequent intervals. These two ropes, in addition to floating and ballasting the net, take much of the strain of hauling and serve as reenforcement for the edges of the webbing.

Webbing manufactured in Japan is more popular in southern California for making sardine nets than the American or European product, partly, at least, on account of its lower cost. Hard-laid cotton seine twine is preferred for wings and landing sack, and cable-laid twine for the greater part of the bunt, particularly the fine mesh; but notions of economy lead some to use the cheaper and less durable medium-laid twine in the wings.

Each fisherman or boat owner builds his net after his own pattern and according to his latest ideas, producing a diversity of design which no doubt makes for progress in the developing of perfect gear. This great diversity makes it difficult to select a type, and when once selected it is almost impossible to draw up specifications which could serve in building a net like the original, for net making is an art and can be learned only by experience. Two nets apparently of the same design will fish with different success, due to the individual skill of the makers expressed in the "hang" of the webbing; hence, the accompanying diagrams must not be considered as working drawings, but only as sketches sufficiently detailed, it is hoped, to portray the characteristic points of the types.

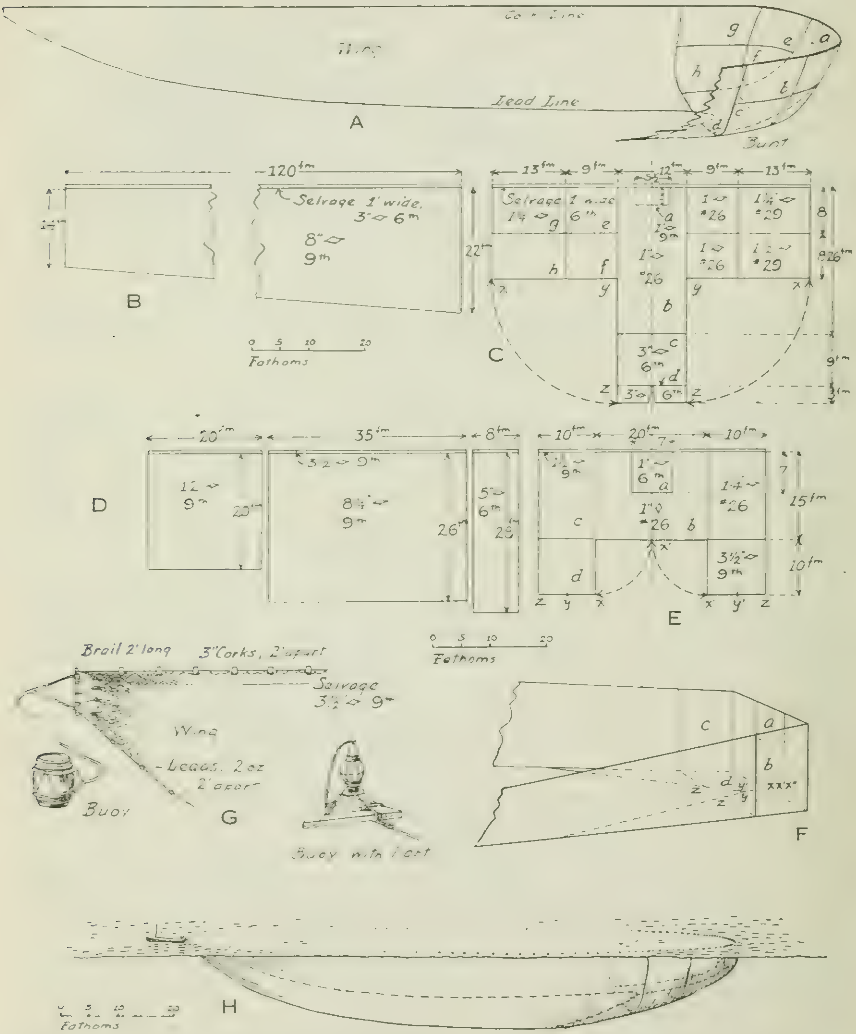

FIG. 68. Diagrams of Italian type of sardine round-haul net or Lampara. A, a perspective diagram of a large Lampara. The right wing only is shown. B, and C, wing and bunt respectively of same, showing pieces of webbing used. The pieces a—h are lettered the same in A and C to indicate their relation. The lines x-y and y-z in C are brought together to form a bag. D, the wing and E, the bunt of a smaller net. F, the bunt of the same net showing the relation of pieces in E. The points x, x' and x'' are brought together and the lines x-y and x'-y' are joined as in F. In all diagrams, a, is the fine meshed landing sack of heavier twine than the rest of the bunt. G, end of wing and buoys for day and night fishing. H, a large net in operation showing relative length and depth compared with a forty-foot fishing boat.

The "Lampara" or Italian round-haul net.

A typical Italian sardine round-haul net or "Lampara" (Figures 67 and 68) is between 150 and 200 fathoms long, and between 15 and 20 fathoms deep, although some reach 300 fathoms in length and 28 fathoms in depth. The webbing is ¾- or 1-inch mesh of six-thread or sometimes nine-thread twine in the landing bag, and 1-inch to 1¼-inch mesh of No. 26 and No. 29, cable-laid twine in the sides of the bunt. The bed of the net is made of a piece of 1-inch No. 26 cable-laid mesh next to the landing bag and pieces of 2½- and 3½-inch mesh of six-thread hard-laid twine next to the lead line. A strip of heavier webbing about a foot wide, of 1¼-inch mesh and nine-thread twine runs the entire length of the bunt and serves as a selvage to which the cork line may be more firmly hung. A similar piece of selvage runs the length of the wings, but is usually 3½-inch mesh of six-thread, hard or medium-laid twine.

The wings are commonly made of three sizes of mesh, the smallest being near the bunt and the largest at the ends. In a 200-fathom net the bunt is 40 fathoms long and each wing twice as long as the bunt, or 80 fathoms. Of this length, about 10 fathoms is 3-inch mesh, six-thread twine, 45 fathoms of 8-inch, six-thread, and 25 fathoms of 12-inch mesh, nine-thread twine. The piece of 3-inch mesh is fastened to the bunt of the net and is the same depth, *e. g.*, 28 fathoms. Each succeeding piece is reduced somewhat in depth so that the wing tapers to 15 or 18 fathoms at the end. This amount of webbing at the end of the wing is, however, gathered into bunches and fastened to a 2-fathom rope or to a wooden brail 2 feet long. Some prefer more pieces in the wings, beginning with smaller mesh, such as 2½-inch, and running 3-inch, 5-inch, and 8-inch mesh at the end of the wings. Others use 8-inch mesh throughout the whole wing (Figure 69).

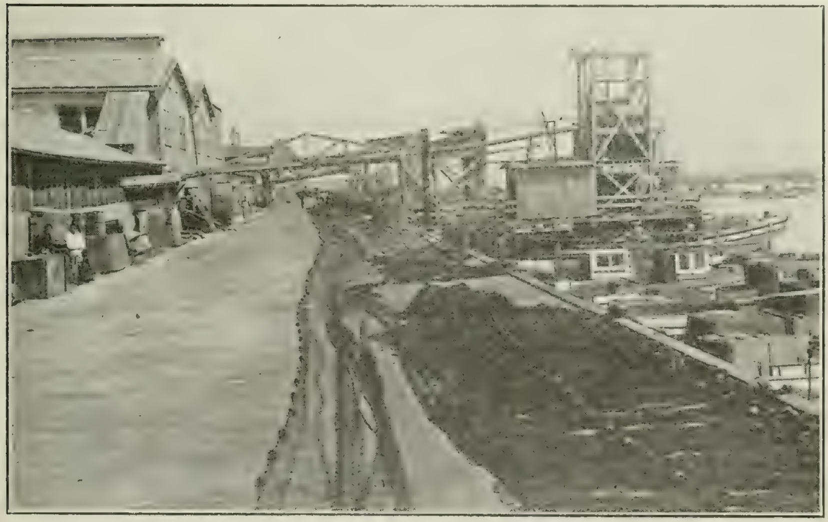

Fig. 69. Lampara net stretched on the dock for drying and mending. Fish Harbor, East San Pedro.

The cork line from which the whole upper edge of the net is hung is a ¼-inch manila line carrying 3-inch corks strung through their centers. Double corks four or six inches apart are placed the entire length of the bunt, and single corks, four, twelve, and eighteen inches apart are used on the wings. The corks are placed close together in the bunt and on the first sections of the wings to add greater buoyancy so that the weight of the fish in the sack, when making a haul, is less likely to pull the net under water and thus allow the fish to escape. The mesh of the bunt and wings is "hung full" on the cork line—*i. e.*, the cork line is shorter than the stretched webbing so as to allow for bagging of the net, by that means giving more room inside the bag and making it pull more evenly in the water. The amount of fullness left in the webbing depends upon the ideas of the individual maker. One method is to stretch the cork and lead lines by soaking them all night in water and then hanging the dry webbing upon them evenly the next day. The webbing will then stretch relatively more than the cork and lead lines when in use, relieving it of excessive strain and permitting sufficient bagging of the mesh. Another method is to first stretch the dry cork line, fastening in position temporarily at intervals the required amount of dry webbing, and later hanging permanently. In this way about 45 or 50 fathoms of webbing are hung on 40 fathoms of cork line to give sufficient fullness.

The lead line is also a ¼-inch manilla rope, like the cork line, but is strung with two-ounce leads one or two feet apart along its entire length. This amount of lead is just sufficient to make the bottom of the net fall readily and straighten out in the water.

The Japanese round-haul net.

The Japanese type of sardine net, although introduced into California later than the Lampara, has grown in popularity and now far exceeds the latter in numbers used. The Japanese net resembles the Lampara in a general way, but differs from it in size—both length and depth—in the shape of the bunt, and in the relative proportions of the bunt and wings.

A typical Japanese sardine net is from 200 to 250 fathoms long and from 25 to 30 fathoms deep, although many are 300 fathoms long and from 35 to 45 fathoms deep (Figures 67 and 70). The bunt is from 30 to 50 fathoms along the cork line, and the wings from three to three and one-half times this length. The mesh is commonly 1-inch, nine-thread in the landing bag; ¾-inch No. 26, cable-laid, in the sides of the bunt; 1-inch No. 26, cable-laid, lower down; and 3½-inch, six-thread, hard-laid, in the bed. The wings are made up of three or five pieces of webbing of different size, of from 3- to 8-inch mesh, arranged as in the Lampara and tapering in depth. A strip of heavy mesh or selvage runs the entire length of the cork line, as in Italian net, but, in addition, a strip of two or three heavy 3-inch meshes runs down the sides of the bunt, making a firm selvage for the attachment of the wings.

A special feature used in some Japanese nets is the purse-line or quarter-rope, a ¾-inch rope, one end of which is fastened to the middle of the lead line by a short halter, and the other end to the lead line of one wing about 15 fathoms out. This line is used to raise the middle of the lead line of the bunt more rapidly than could be done by hauling only on the wings. This is a desirable feature, for as soon as the lead line is raised the catch is made certain, the fish being then confined in the fine-meshed portion of the net.

It is difficult to discuss the relative merits of the two types of sardine nets, as both Italians and Japanese seem equally successful in catching

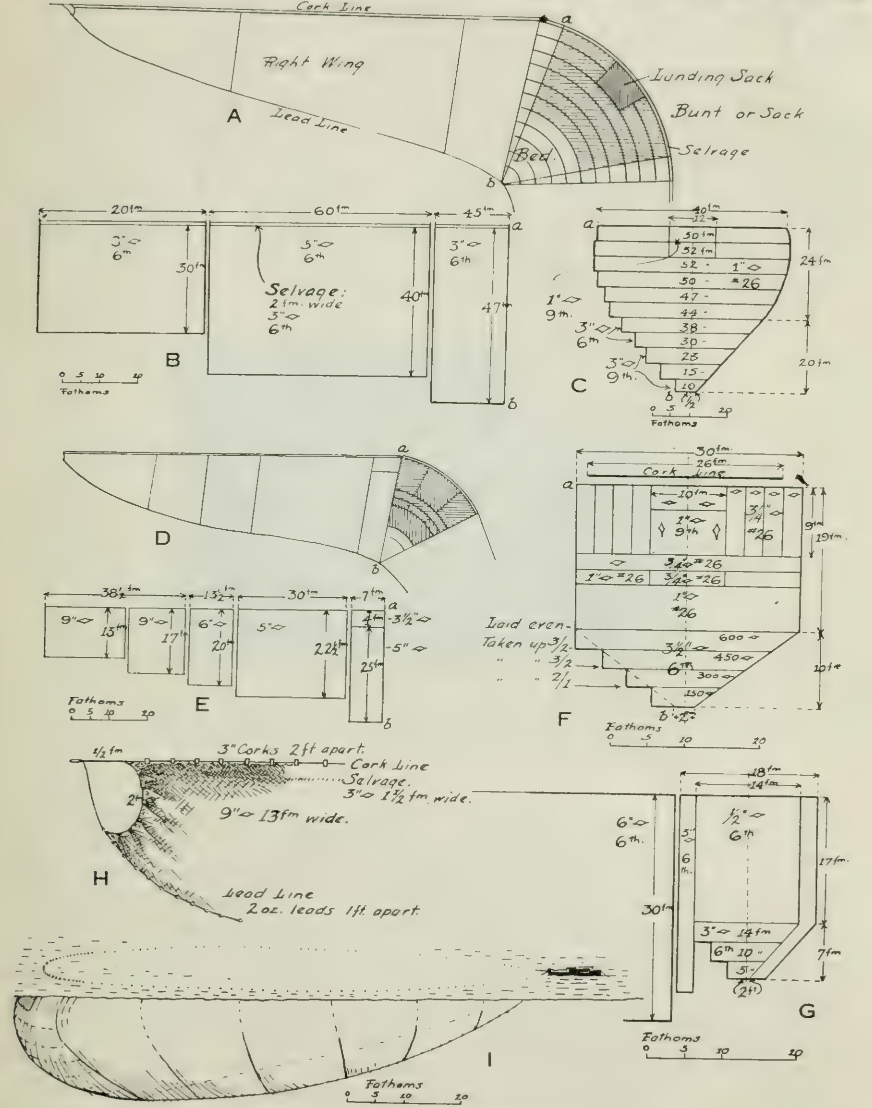

Fig. 70. Diagrams of Japanese type of sardine round-haul nets. A, a large net showing wing and bunt. B, and C, wing and bunt respectively of same, showing pieces used in making. The adjacent edges are brought together evenly by taking up the longer into the shorter lengths. The left side of C shows the pieces stretched and the right side after being taken up. D, a smaller net; E, and F, wing and bunt of same. Many more pieces than indicated may be used in the wings to produce the proper taper. G, the bunt and part of the wing of a bait net. H, method of fastening the end of the wing. I, a net in operation showing relative length and depth compared with a fifty-foot fishing boat.

fish. The popularity of the Japanese nets may be due to the great increase in the number of Japanese fishermen who naturally use their own methods, and the acceptance of this type by other nationalities may be due to its relatively simple design. It is argued that the greater depth of the Japanese type makes the net more generally useful than the Italian, since it can be used in deeper water away from shore. It is further said that the smaller amount of fine-meshed web in the Japanese net reduces the cost of construction and allows the building of a larger net with greater fishing capacity without corresponding increase in cost. Other fishermen declare that it is less difficult to operate a Japanese net, as cross currents are less likely to close the bag than is the case with the Lampara, and that the greater proportion of large mesh makes the net easier to pull. Whatever the facts may be, the fisherman of each nationality stoutly maintains his belief in the superiority of his gear, and both types will probably exist as long as Italians and Japanese continue to fish for sardines.

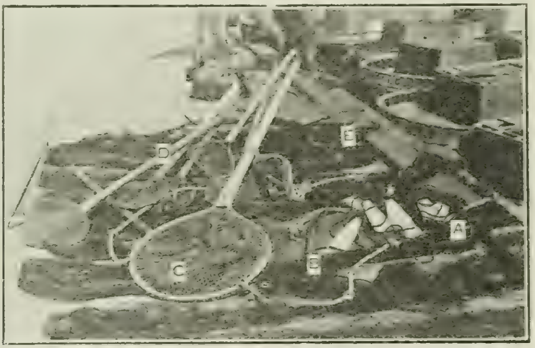

FIG. 71. Miscellaneous gear. A, and B, line and weight of the scare, with paddles piled between; C, dip-net for landing the fish; D, shovels used in unloading; E, side boards and checks for confining the catch on deck.

Bait nets.

The bait net is an important modification of the standard sardine gear. It is an almost necessary piece of equipment for the albacore boat, for live bait is required daily during the summer season. Some fishermen, moreover, make a practice of supplying small sardines to the market to be used as bait for the mackerel and set-line fisheries, and for this, bait nets are used. Bait nets are small sized Lamparas or Japanese style round-haul nets ranging from 75 to 150 fathoms in length and from 12 to 20 fathoms deep. They are usually more simple in construction, fewer pieces of webbing being used. The webbing in the bunt is of $\frac{1}{2}$- or $\frac{3}{4}$-inch mesh, but the mesh of the wings is about the same as in the larger nets.

Miscellaneous gear.

Many other kinds of gear may be mentioned which are used directly in catching or handling sardines, such as buoys, skiffs, plungers or scares, and dip-nets (Figure 71). A brief description of each will be given here, but details of their use will be left until later in this paper.

The Italian fisherman uses a red-painted, five-gallon keg as a buoy to float and mark the end of his net when fishing in the daytime. For night fishing, either a similar keg, weighted, and carrying a lantern, or a simple buoy made of crossed pieces of wood so as to float level and carry a light, is used. The Japanese, however, tow a twelve-foot skiff, lighted with a lantern at night, behind their fishing boat, to be used in place of the buoy.

The scares or plungers used in driving the fish back into the net are of many kinds. The simplest form is a weighted board two or three feet long, fastened to a ten- or fifteen-fathom line. Another kind used on some boats is a two- or three-foot length of iron pipe, open at the lower end but fitted to a short wooden pole at the other. This is also fastened to a light line so that it may be thrust down and rapidly hauled in again. Still another type is made by weighting one end of a long rope with a ten-pound window weight and fastening eight or ten white-painted wooden paddles about ten inches long and four inches wide at fathom intervals along its length. This seems to be a very efficient scare, as the paddles dash about irregularly when the line is jerked up and down in the water.

Two kinds of small ring nets are used: one is a dip-net for bailing the fish out of the water, the other really a shovel for unloading the catch. The dip-net is a shallow bag of heavy 2-inch webbing fastened to an iron ring two or three feet in diameter which is fixed on a heavy pole or handle about eight feet long. Short lengths of rope are fastened to either side of the ring to help in lifting the net filled with fish on board the boat. Another rope is fastened to the bottom of the net and is used in dumping the fish by raising the bag. The small nets used as shovels are made of heavy mesh stretched tightly over iron rings ten inches or a foot in diameter, with wooden handles four feet long. They may be circular, square, or semicircular, with the flat side away from the handle to make it easy to shovel up the fish from the flat deck. These particular implements are used instead of iron shovels to avoid cutting or bruising the fish more than necessary in unloading.

Care of gear.

Sardine nets are continually in need of mending. Defective meshes giving away causing small tears, large fish becoming entangled or plunging through the net, hidden snags—a hundred causes—keep the fisherman mending and mending before and after hauls and while waiting to unload the catch. Frequently the weight of the fish caught in the net is so great that rents are made great enough to allow the whole catch to escape. If possible, the repairing is done on the boat, but if the damage is too great the net must be spread out on the dock, and the whole crew goes to work with full-wound seine needles to repair the tear.

The standard method of preserving net material is by tanning the webbing in a hot decoction of red-oak tan-bark (Figure 72). Two sacks, or 120 pounds of bark, is placed with 100 gallons of water in a large tank and boiled for one hour. The fluid is allowed to cool somewhat and the net is put in and soaked for two hours or more, at a temperature less than boiling. Care is exercised to avoid heating too much, as the net is said to burn, causing quick "rotting" of the fabric.

Many canneries provide vats for tanning, heated with steam coils, but where the fisherman does not have access to such equipment he heats his tanks of tanning solution with a wood fire built in a pit in the ground. Nets are never tanned before storing away at the close of the season, but only while in actual use, for it is believed that rotting is more rapid when an excess of tan is left in the fabric.

Nets are dried as frequently as possible as a precaution against rotting, and windy days or periods when fish are scarce are always occupied with spreading nets on the docks or on the sandy ground for drying and mending. Rotting of the net when wet is also guarded against by careful protection from the sun. As soon as the day's catch is made, the net is piled in order and covered with a tarpaulin made of heavy canvas.

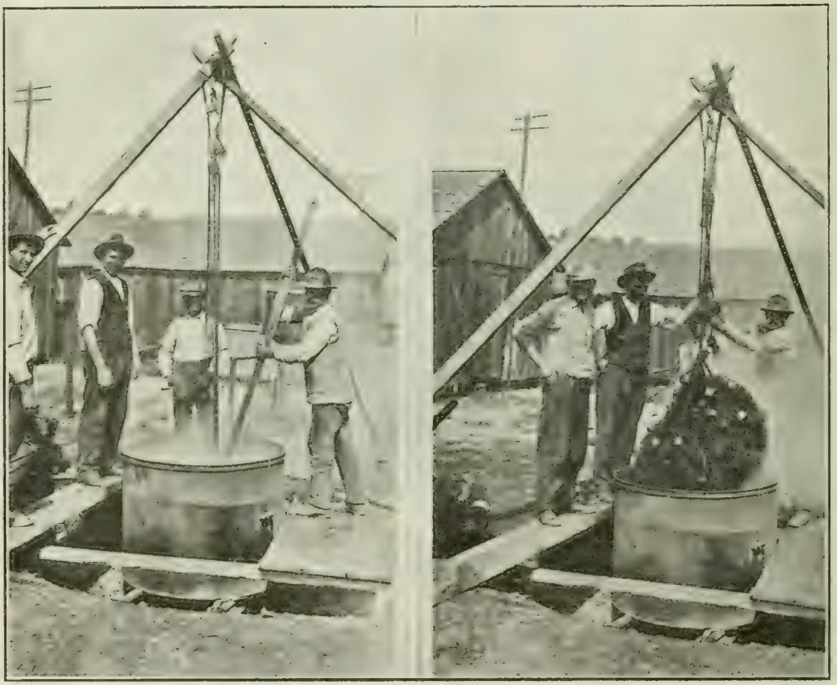

FIG. 72. Tanning nets. The nets are preserved from mildewing by soaking for several hours in a hot decoction of tan bark.

Cost.

With ordinary care, a sardine net will last for two fishing seasons, but during the third season it is usually necessary to replace so many pieces of webbing that the net can hardly be called the same as the one at the start. A sardine net at the prevailing prices of the last two years, represents an outlay of from $1,000 to $3,000, but the cost of continual repairs makes the annual cost of operating a net from $300 to $1,000.

METHODS OF FISHING.

Time.

It is the fixed opinion of some that day fishing yields more mixed or small sizes of fish than night fishing; others notice no difference. Large and small fish are caught both day and night, but it may easily be true that differences in the schooling of the fish make the larger fish more accessible at night and so increase the average size of the fish in the total catch. At any rate, the demands of the canneries for large fish—pound oval size—combined with the greater accessibility is responsible for the greater part of the sardine catch being taken at night. The fish are most easily located on the darkest nights, hence, the two-week period during the dark phases of the moon is most successful. Day fishing is only resorted to when less than two or three hours of darkness is left between nightfall and moon-rise or moon-set and dawn. When fishing in the day time, the hours of early morning are the most favorable as the schools of fish can be most easily located when the water is calm.

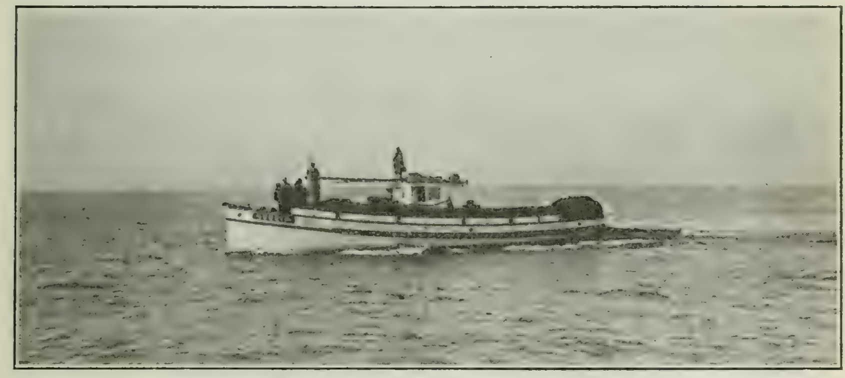

FIG. 73. Searching for schools of fish. The crew on the bow and the man on the pilot house anxiously scan the sea for birds, darkened areas of water, or ripples on the surface which indicate the presence of fish. A typical Japanese boat.

Locating the school of fish.

The schools are located at night by the phosphorescent light produced by the movement of the fish in swimming. This explains the dependence of the fisherman upon the phases of the moon, as even a small amount of moonlight, or even bright starlight, makes it difficult at times to see the pale light of the phosphorescence. The running lights of the fishing boats are even darkened by covering them with cloth so that they may be seen at a short distance by other boats but will not give enough light to obscure the evidence of fish. Very dense schools may often be located at some distance by the dull ''fire'' but when the fish are more scattered it is necessary to pass over them to discover their presence.

Smelt and anchovies school closely enough and are near enough in size to be mistaken for sardines by the ordinary observer, at least at night, but the fisherman distinguishes between them readily by the courses of the fish as they dash away from the boat. Smelt swim away in undulating courses leaving wavering, snaky trails of light. Anchovies, being feebler swimmers, dart away in short, curved dashes. Sardines are more powerful and dash away, leaving long slightly curved trails resembling the luminous paths of sky rockets.

There are several ways of locating sardines in the day time (Figure 73). A school may be discovered at a distance by seeing the gulls, fulmars, and shearwaters flying in circles and feeding upon the splashing fish. The water may also appear dark from the mass of fish below, and at close range the fish may be seen splashing on the surface. The character of the splash serves to distinguish sardines from anchovies, the former throw their tails above the surface without a marked silvery flash, while the latter flip over sidewise on the water showing their silvery sides and reflecting flashes of light. Some fishermen locate deep-lying schools in quiet water by the "bead"—minute bubbles which come up from below and bead the surface of the water like rain drops.

Making a haul.

Having located a school of fish dense enough to warrant an attempt, the crew stands in readiness to lay out the net while the skipper, noting the wind and current, circles and maneuvers the boat into proper position. The net is always laid out in relation to the direction of the wind so that the boat may not blow back over the net, and to the direction of the current, so that the net may not be swept shut or prevented from opening fully.

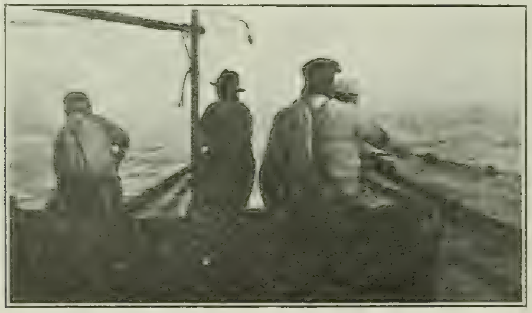

FIG. 74. Hauling in the wings. The activity here shown is accompanied by the excitement one feels before actually landing any other kind of fish.

In making a haul, the net is laid out in a huge circle about the school of fish, the ends brought together and hauled in, impounding the fish in the bunt of the net. Running ahead at full speed, the skiff is released or the buoy thrown overboard, and its weight drags the end of the net into the water. The net is piled in the stern of the fishing boat so that one wing is paid out first, cork line and lead falling far apart in the water so as not to tangle. When one wing is paid out, the whole pile of bunt is thrown overboard at once, and the second wing is then dragged out by the weight of the net and speed of the boat. When the net is nearly all overboard the boat slows down in preparation for picking up the skiff, but should all of the net be paid out before the skiff or buoy is reached, a one-inch line already attached to the net is slacked away under strain as far as necessary, and then hauled in again when the other wing is reached.

As soon as both ends of the net are recovered, the launch is anchored at once, if in shallow water, with a light kedge anchor, the skiff tied forward out of the way, and all hands immediately begin hauling in the net with all possible speed (Figure 74). Care is taken to pull both wings at the same rate, cork line, lead line, and webbing coming in evenly; and as an aid, marked corks are placed on each wing at equal distances from the center. While the wings are being hauled in, one man operates the scare or plunger described above. This scare is

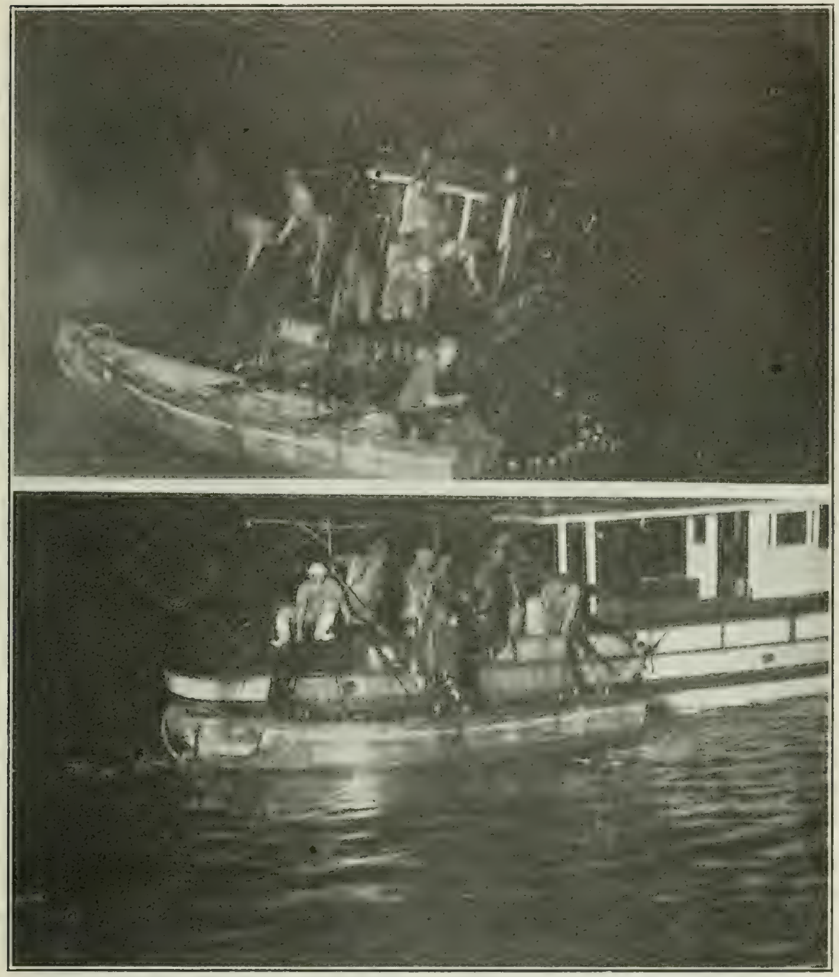

Fig. 75. Sardine fishing in the black obscurity of midnight. This is the typical condition under which ninety per cent of our sardines are caught. Above, hauling in the bag; below, dipping the fish from the net.

jerked vigorously up and down at the stern of the boat to frighten the fish back into the net and prevent their escape from the open side beneath the boat.

The wings of the net are hauled in until the lead line, being shorter than the cork line, is brought on deck. Thus far all work has been performed in absolute darkness, every light on the boat being entirely darkened so as not to attract the fish toward the boat and out of the net, but as soon as the lead line is brought on deck making escape impossible, the deck lights and running lights are turned on (Figure 75). The weight of a large catch of fish in the bag is sometimes sufficient to pull the cork line under water, allowing many of the fish to escape. The Japanese prevent this by one man rowing with the skiff to the outer side of the net and supporting the cork line. (Figure 63). He later helps operate the dip-net in landing the fish.

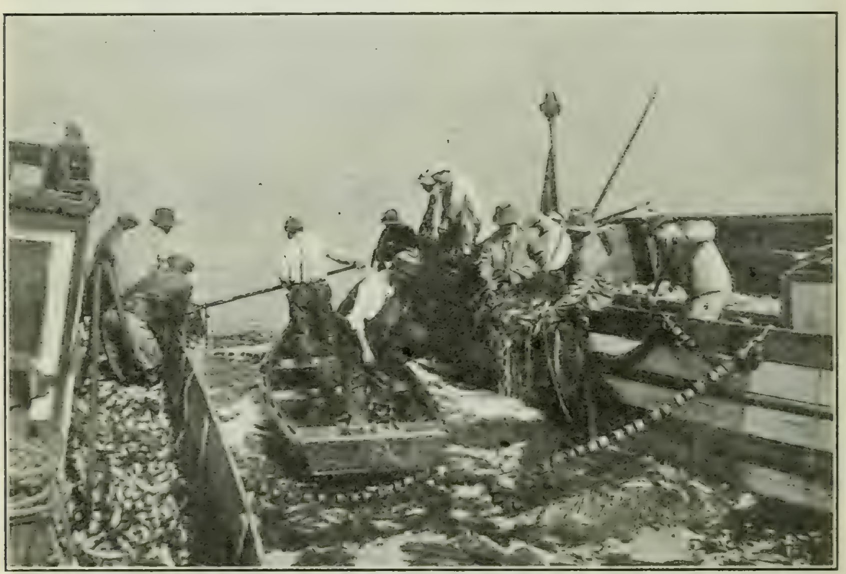

Fig. 76. Bailing the fish from the net. Two boats have come together to load from one successful haul. The men in the skiff dip the fish from the water while two men on each fishing boat hoist the nets on deck and dump them.

The hauling in of the mesh of the bunt continues until the fish are crowded into the landing bag and their weight makes further hauling too difficult. The cork line is drawn up into a circle about ten feet in diameter and partially supported by boat hooks. The fish are then bailed from the net with a large dip-net, dumped on deck, and shoveled forward to make room for subsequent hauls. Three men work together with the dip-net in landing the catch, the others holding the net by sitting on the webbing and spreading the cork line with boat hooks. Often two boats will come together and take their loads from one successful haul (Figure 76).

Preparing for the next haul.

As soon as the catch is landed and disposed of on the deck, the bunt is sometimes roughly washed to remove excess scales and slime, serious tears are temporarily mended, and the wings and bunt piled on deck in preparation for the next haul. It is the practice of most fishermen to circle to the right in laying out the net. When this plan is followed, the left wing of the net is carefully coiled on the port side of the stern, cork line and lead line well separated. The bunt of the Japanese net is piled on top of this, but the bunt of the lampara is piled separately next to the wing so that the whole pile may be thrown overboard at once, avoiding strain on the webbing which might tear the net. The right wing is then coiled to the starboard so that when the skiff is released or the buoy thrown out, the net will pay out freely. On boats which circle to the left, this arrangement of the net on the deck is reversed.

Size of hauls.

The quantity of fish taken in a single haul varies between the many, many weary hauls containing nothing, and the rare streaks of fortune containing over one hundred tons. The capacity of the larger Japanese boats does not greatly exceed twenty-five tons, and when such large hauls are made other boats are called and loaded from the overabundance. During the present season, limit catches of ten to fifteen tons could frequently be taken in one haul, but at times boats whose weary crews had made eight or ten hauls would return from a night's fishing with a ton or even less.

The Fish and Game Commission has legal authority to prevent wastage by limiting the size of the loads according to the tonnage of the boats, for if the fish are piled too deep on the deck, heating and pressure on

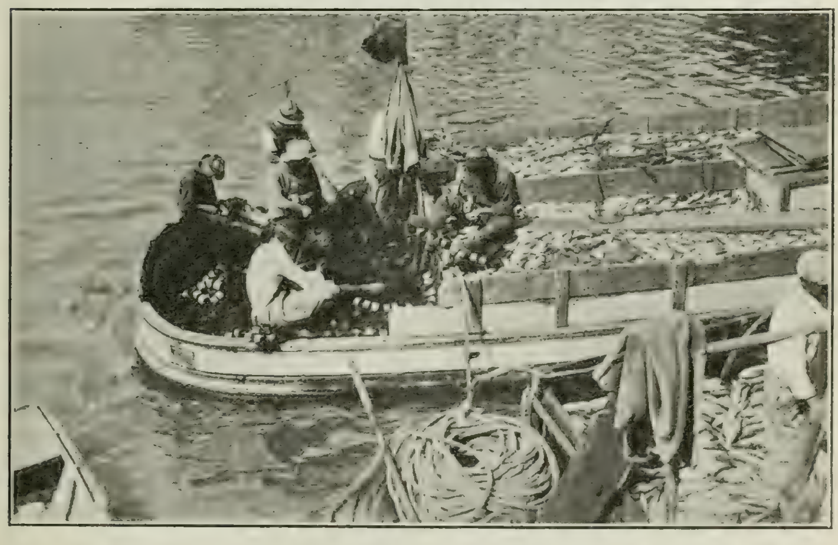

FIG. 77. An "idle" moment while waiting to unload. Seine needles are busy with never-ending repairs on the net.

the lower layers renders a large part unfit for canning. During the past season, however, the amount used for canning was small and the surplus was converted into fish meal. The only limits imposed on the catch, therefore, were those required by cannery practices.

Disposing of catch and washing net.

As soon as the night's catch is taken, the run to port is made without loss of time, as the first boat to tie up at the cannery hoist is the first to unload. Most of the canneries start receiving fish at seven o'clock in the morning, but by daylight a long row of loaded boats is tied up, side by side, waiting their turn at the hoist. If the boat gets in before morning, the entire crew will turn in for a few hours sleep on the boat, or if living near the water front, will go home, estimating by the position of their boat in the waiting line the hour to return. But if the boat arrives late and is required to wait but a short time before unloading, the crew sets to work with ever-ready seine needles mending holes in the net (Figure 77).

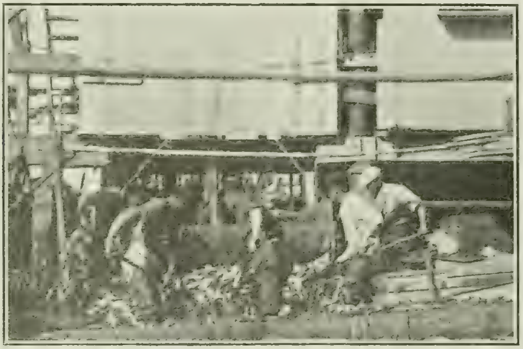

FIG. 78. Unloading the catch. The fish are shoveled into the hopper where they fall into buckets to be hoisted into the cannery.

The boat is unloaded by shoveling the fish into the cannery hoist with the small net-like shovels described above. The fish from the after-deck space are first unloaded and when these are gone, the ones piled forward along the sides of the cabin are sluiced down to the after-deck with running water from a hose. Six or seven men are able to discharge an average load in about a half hour at canneries using a continuous conveyor, but more time is required where a single bucket hoist is used (Figure 78).

As soon as the boat is unloaded, the deck and deck houses are thoroughly scrubbed with running water and the side boards thrown into the water to remove scales and slime. The boat then backs out of line to allow the next boat to be pulled up to the unloading hoist, and runs outside away from the canneries to wash the net. The pieces of kelp and occasionally gilled fish are carefully picked out of the webbing, and the bunt thrown overboard and dragged through the water for some distance to wash out the slime. The crew then slowly hauls it in, shaking and sousing the webbing repeatedly to complete the cleaning. Thoroughly washed nets last much longer than carelessly cleaned ones, and thrifty skippers are very particular about the amount of shaking and rinsing their nets receive after each day's work.

Thus it may be seen in following the course of operations, that sardine fishing, even under the mildest and most favorable of natural conditions, entails long hours, heavy labor, and uncertain returns. Only those who are born to following the sea are attracted by the possibilities of fishing, and hence the industry has fallen into the hands of those from foreign lands where fishing is a profession, and not a mere means of living.

CALIFORNIA SARDINE FOOD PRODUCTS AND THEIR PREPARATION.*

By Harry R. Beard.

The outbreak of the World War in 1914 brought about a large increase in the demand for food products. Normal production of most foods require time and the use of valuable raw materials. The world's fisheries, however, were furnishing large quantities of excellent food without such serious drawbacks. Moreover, this supply could be greatly increased and, by using methods of preservation, it could be made available anywhere. In addition, the increased quantity of by-products from fish would be of almost equal importance. This is obvious when one considers the things which may be derived wholly or in part from fish wastes. Some examples are: fertilizers, stock and chicken food, glue, oil, glycerine, soaps, explosives, paints, waterproofed fabrics, lubricants, medicinal products, salad oils, butter substitutes, candles, artificial jewels, and ornaments for hats and dresses. Demands for food and for these products naturally led to a vast expansion of the fish industry.

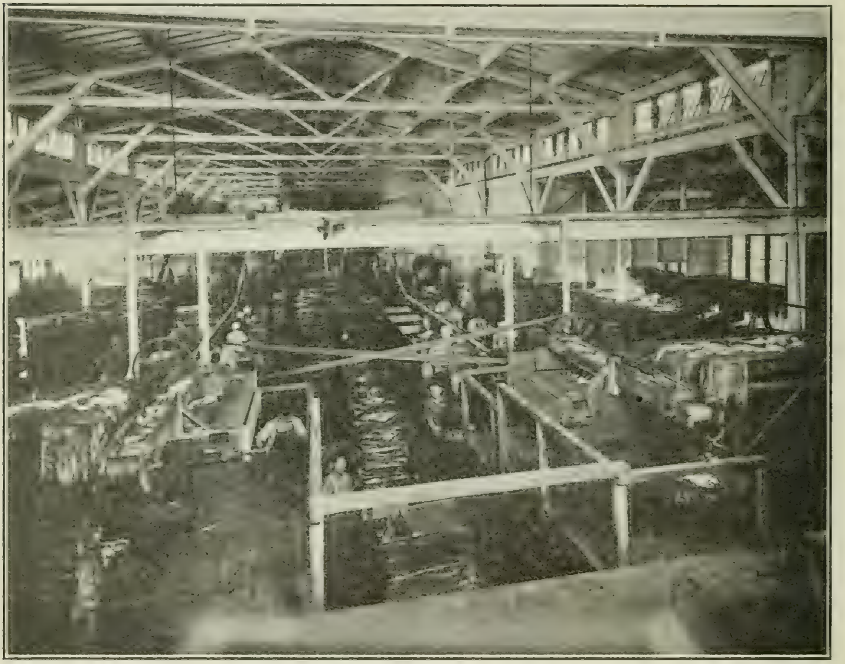

Fig. 79. Sardine cannery.

An excellent example of this expansion is shown by the rapid growth of the California sardine industry during the war period. In 1920

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*Contribution from Preservation Laboratory, Fish and Game Commission of California, San Pedro.

California's production had risen to a place where it was almost leading in the race for world supremacy. In addition it can be said, that California canneries are second to none in sanitation, equipment, methods of packing, and in the variety and quality of food products produced.

A short description of these products, their preparation and food values follow.

FOOD PRODUCTS.

The sardine packer offers to the trade excellent food products put up in ways various enough to suit any taste. Moreover, most of these products are sold at prices low enough for everybody. The canned products enjoying the greatest popularity are the so-called ''pound oval'' and ''quarter oil'' packs.

A can of ''pound oval'' sardines usually contains four to seven large sized fish which have either been steamed in the can or fried and then packed into a flat oval can with tomato sauce. This is the cheapest and most popular pack put up by the industry.

Next in order of importance is the ''quarter oil'' pack. Here one finds fried ''baby'' sardines tightly packed with olive oil into quarter-pound flat cans.

Many other products are put out in smaller quantities. These depend upon the resourcefulness of the packer and the demands of his trade. For instance, the size and shape of the can is varied as well as the size of the fish put into it. Sauces placed in the can include, in addition to tomato, mustard, souse (vinegar and spices), and soy for the orientals. Fancy packs are prepared by making fillet of sardine, by smoking to add the delicate flavor obtained in that manner, by grilling, by packing in glass, and by making mixtures with other foods. Considerable quantities of salted, pressed sardines are sold to the foreign trade.

PACKING.

Sardines are canned in modern packing establishments situated on the waterfront close to the fishing grounds. The size of different plants varies greatly. Some are able to handle only a few tons of sardines a day while others can easily care for 100 tons in the same period of time. The internal arrangement of space and equipment differs in most canneries, yet in each case the arrangement was planned to expedite the process.

Mechanical equipment of the latest type is used wherever possible, making the procedure mostly automatic in the larger plants.

Particular attention is paid to sanitation in all canneries. Cement floors are used to a great extent, as they are easily washed after a batch of fish has been cared for. The fry-baths, trays, and packing tables are cleaned after use by treatment with a solution of soap or caustic soda followed by plenty of water. The women who pack the fish into cans wear white aprons and caps. They are required to keep their hands clean and their nails manicured. Precautions of a like character are required of all personnel who handle the fish.

The methods used in preparation and canning of fried ''pound oval'' sardines are representative of those generally used in California for preparing most canned sardine products. These methods will, therefore, be given in detail. Following this description, a few general statements will be made concerning the preparation of steamed "pound oval" sardines and of the other packs which have been described above. In these connections, it is to be kept in mind that the methods given here are subject to considerable variation in the many canneries. These changes, however, are only different means of attaining the same end.

Description of a process is probably made clearer if it is treated according to the steps into which it naturally divides itself. This plan is used here in describing the preparation and canning of the "pound oval" pack.

Preparation and canning of the "pound oval" pack.

Receiving. Sardines are received fresh from the fishing grounds, having been rushed to the canneries to prevent decomposition. They are shoveled from the boats into a mechanical hoist which raises them to an elevated platform where they are weighed. Water and gravity then carry the fish from the weighing vat through a trough into the cannery proper.

Scaling. The first operation in preparing sardines for canning is to scale them. This is accomplished by passing them through a large cylinder of heavy screening, which is rotating in a tilted position. Most of the scales are removed by the rubbing of the fish against each other and against the screen wall of the cylinder. Water is sprayed on the fish at the same time to help remove the scales and to wash the fish. The sardines are discharged on the cutting tables.

Cutting. In at least one cannery in the state an attempt is being made to cut sardines by a specially devised machine. However, this is an experiment. Cutting is usually done by Japanese women. They are paid by the number of buckets of cut fish delivered to the checker, who keeps score by punching a card, which hangs on the cutter's back. Cutting, therefore, develops into a sort of race: each cutter trying to make more money than anyone else. In some cases a cutter makes as high as a dollar and even more per hour when the price paid is thirty to thirty-six cents per hundred pounds of cut fish.

This sort of a race is desirable, as the fish do not tarry long on the cutting tables. In addition, a large number of cutters are employed, so the period only lasts a few hours.

The cutting operation is carried out in the following manner: The fish is taken from the table with one hand and held belly down on the cutting board. One cut with a sharp knife suffices to remove the head and part of the body from the sardine. A sideways motion with the knife removes the entrails and forces all the refuse through a hole in the table. At the same time, the other hand drops the cut fish into the bucket. The refuse from this operation goes to the by-products plant, where the oil is removed and the residue is made into fish meal.

Brining. The cut fish are placed in a large wooden vat containing an almost saturated solution of salt in water. The fish remain immersed in this brine for about thirty to sixty minutes. The time used varies according to the strength of brine, the temperature, and the size of the fish. A man skilled in brining determines when the fish have been brined sufficiently by observing their appearance.

Brining accomplishes several things. Some water, blood, and soluble proteins are extracted. Salt goes in the other direction, penetrating the flesh and making it firmer.

Drying. Brined fish normally contain too much moisture to fry and can well, so the excess is removed by means of hot air.

The apparatus usually used is a tunnel drier. This consists of an elongated chamber, varying from the size of a small, narrow room to the size of a large hallway. Large fans rapidly blow or suck air through a series of steam coils, then through the chamber. In one popular type of drier the sardines pass through the chamber once on an endless wire belt. In their passage they are subject to hot dry air forced down onto the fish by baffle plates. In another type an endless wire belt carries the sardines to the top of the drier and through it. They then fall on a belt traveling in the opposite direction. A set of belts placed one below another repeats this operation several times before the fish leave the drier. In some types belts are not used. Instead of such apparatus, tiers of trays containing sardines are wheeled on trucks into the chamber and allowed to remain until the degree of drying is complete enough.

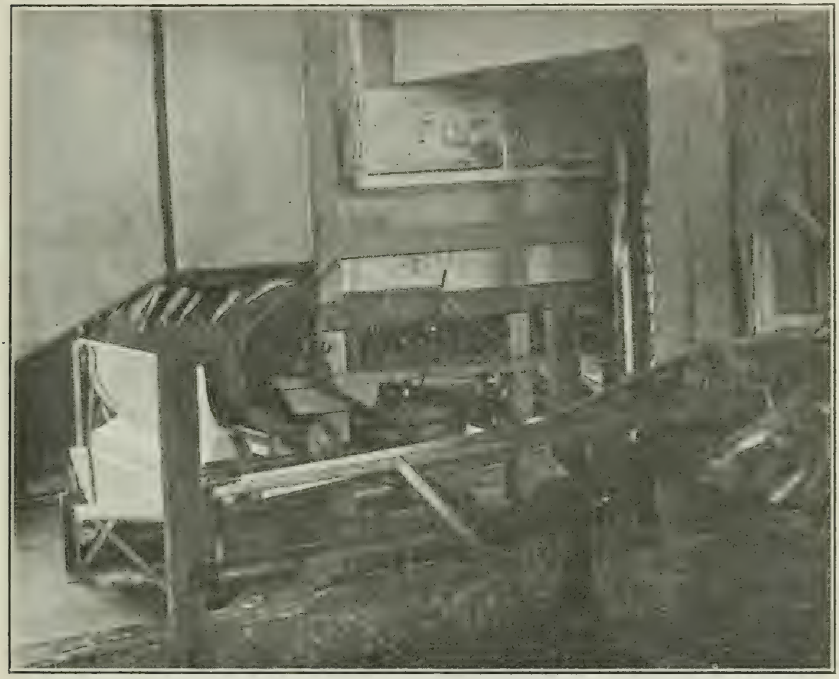

FIG. 80. Sardines coming from the dryer.

The time necessary for sufficient drying depends mainly upon: the rate, temperature, and moisture content of the air used; and upon the size of the fish. The time is easily controlled by changing the speed of the belts. Where trays are used the method of control is obvious.

In most cases an hour or less of drying is sufficient. The appearance of the fish is used as a guide in determining the sufficiency of this operation.

Frying. The sardines are conducted from the drier to the fry-bath, where preliminary cooking is accomplished.

Shallow wire trays are partly filled with the dried sardines (if they are not already in trays) and slowly passed through cottonseed oil heated to a temperature ranging from 215 to 240 degrees Fahrenheit.

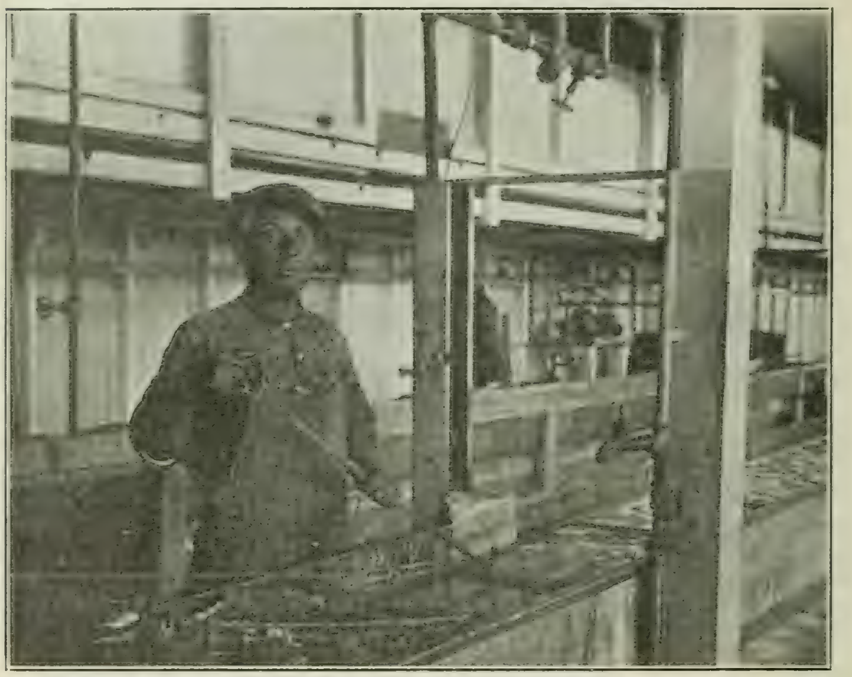

FIG. 81. Frying sardines.

The apparatus used consists of an elongated metal vat, inside of which is placed, midway of its depth, a horizontal set of steam coils. An endless chain conveyor runs just above the steam coils, carrying the baskets of fish through the length of the bath. Water is added to the bath until it almost comes to the bottom of the steam coils. Enough oil is then floated on top of this water to cover the baskets of fish which are to be carried through it. At times this amount of oil is over a thousand gallons. The temperature is controlled by varying the amount and pressure of the steam which is sent through the coils immersed in the oil.

Frying in pure oil brings out the excellent sardine flavor. In addition, part of the oil is carried on by the fish and this adds to the delicacy of the final product. This operation removes considerable moisture and some soluble extractives from the fish. Part of this water goes off as steam. The rest sinks with the extractives and solid particles coming from the fish. These collect in the layer of water under the oil. After a day of frying the oil is separated from the water and other waste materials. The bath is then cleaned before the oil is returned to it.

The condition of the fish is used in determining the correct amount of frying. If, after removing the tail and holding the fish in one hand, the backbone can be removed easily and cleanly and shows no uncooked blood, then the process is deemed sufficient. Around eight minutes is the time needed for frying "pound oval" sized fish when the temperature of the oil is close to 230 degrees Fahrenheit.

The trays coming from the hot oil are placed on trucks and allowed to remain there until the fish drain and cool.

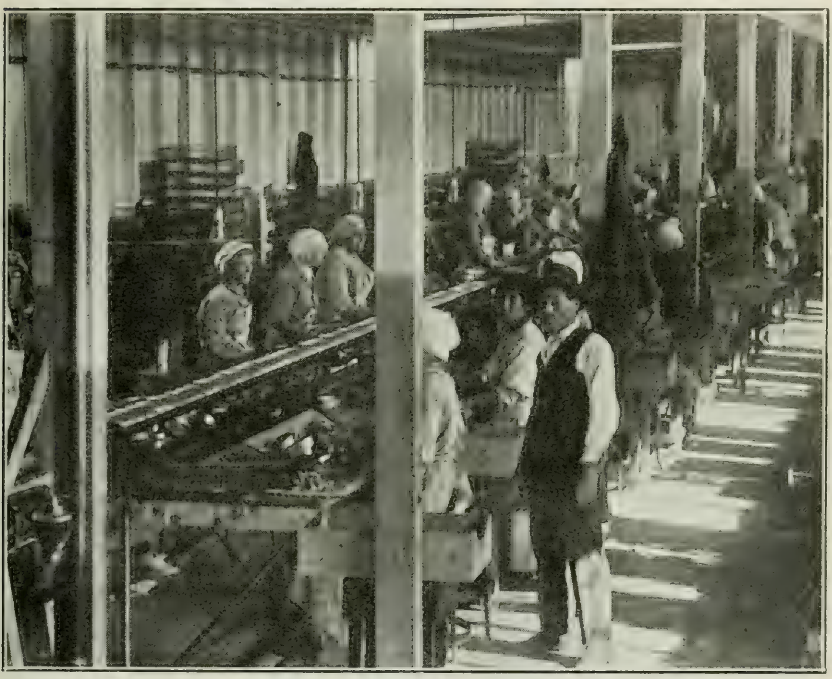

FIG. 82. Packing sardines.

Packing. After sufficient cooling the trays of sardines are placed on the packing table where women discard the broken fish and pack the others into clean cans.

The packing table is in a clean, light, airy part of the plant. It is arranged so as to give individual working space to each woman who has a tray of fish and a box of cans within her reach.

The cans come through a chute from a different part of the plant or they are brought in in cases. Each woman has a card which is punched every time she receives a case of cans. This is used as the unit of pay for her work. Some of the women make as high as a dollar or more per hour when the price paid is thirty cents per hundred cans packed.

The women carefully pack the fish into cans and then place them on a belt conveyor which carries them past an inspector, who discards the poorly packed cans. They then go to the sauce distributors.

The steady stream of cans on the belt conveyor passes under a mechanical sauce distributor which adds the correct amount of tomato sauce to each.

Exhausting. When cold sauce is added to the cans they are heated before they are sealed. This is necessary to prevent trouble later. Explanation of this is easily given. Cans sealed cold on a cold day have all empty spaces full of cold air. Later when a hot day comes the air expands and the cans swell. Addition of hot sauce followed by immediate sealing cares for this difficulty. Another method of accomplishing the same end is to exhaust the cans by heating them after the sauce is added. This is brought about by allowing them to continue on the belt conveyor through a narrow chamber long enough to permit the steam pipes contained therein to heat the contents thoroughly.

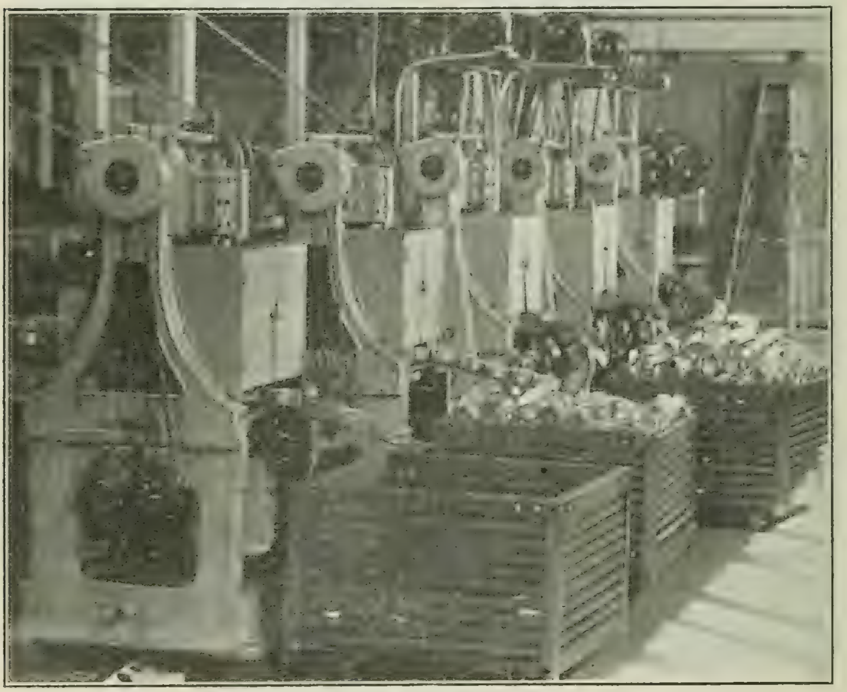

FIG. 83. Sealing cans of sardines.

Sealing. The cans are carried on the belt conveyor to an automatic sealing machine, which literally picks one of them up, puts a lid on it and with a whirl seals the lid to the can. Some machines do this forty or more times to the minute. The can carries a flange which fits into a groove in the lid having an extended edge bent downward. In sealing, the flange of the can and the edge of the lid are interlocked so as to form a double seam. The groove in the lid carries a very thin layer of a sort of rubber compound, which serves as a gasket between the seams.

The cans fall from the machine into a large metal truck. This truck, which holds a very large number of them, is made to fit the retort used in processing.

Processing. Sterilization of the contents of the can is necessary to insure its keeping qualities. In addition more cooking is desirable. Proper heat treatment accomplishes both of these steps at one time.

The truck containing the cans from the sealing machine is wheeled into a large steel retort. The door is then tightly closed. Live steam under pressure is turned into the retort. This heats the contents of the cans to a temperature above the boiling point of water. Various temperatures and times are used in this step; however, it is certain that a temperature of 240 degrees Fahrenheit applied for two hours is sufficient. Further, it leaves a margin for safety. The cans are water cooled after processing (or retorting as it is often called).

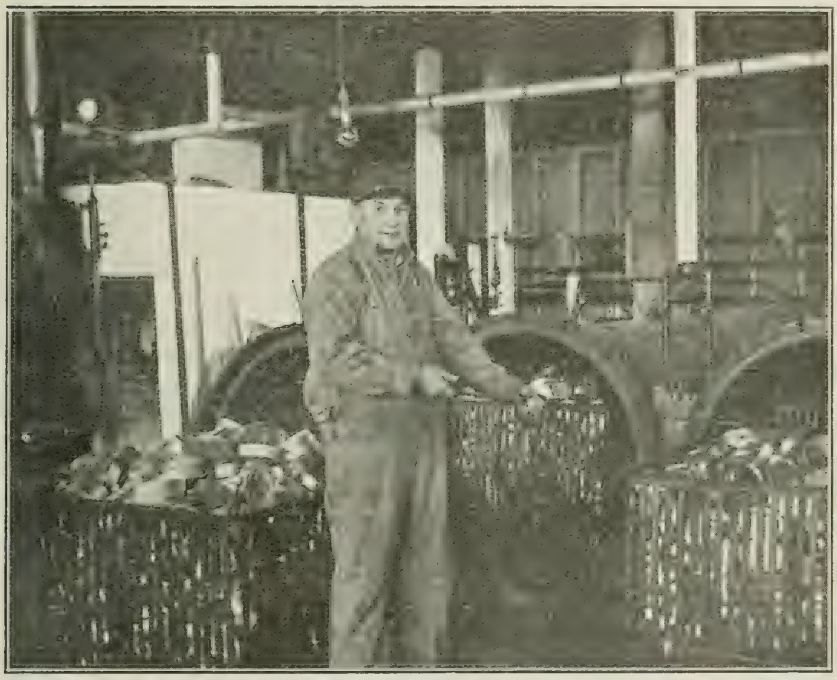

FIG. 84. Processing canned sardines.

The high temperature and time used, sterilizes and thoroughly cooks the sardines. Even the bones are made soft and edible.

The cans are next washed in soap solution and allowed to dry. They are then conducted to a room where they go into temporary storage.

Testing. The cans are allowed to remain in temporary storage for about two weeks. At the end of this period each one is examined and those which were not tightly sealed thrown out. These cans are easily discovered as they have a distorted appearance. They are called "swells." Such condition is brought about by bacteria which enter and act upon the contents. The other cans are then labeled and packed into cases, ready for shipment anywhere.

Preparation of steamed "pound oval" sardines and of other packs.

Steamed "pound oval" sardines are prepared in a manner quite similar to the fried pack. After brining the fish are packed into the cans without drying. Preliminary cooking is accomplished by inverting the filled cans and steaming them. The inverted position permits drainage of the oil and extractives cooking out of the fish. After steaming the same procedure is followed as after frying. This pack can be made more cheaply than the fried one and many people prefer it, too.

"Quarter oil" sardines are prepared and packed in the same way as the fried "pound oval" pack, except for variations in the procedure necessitated by their small size.

Kippered sardines are prepared by placing the fish in chambers where they are treated with hot smoke. This cooks and smokes the fish in the same operation. They are then packed into the cans with or without sauce, sealed, and processed.

FOOD VALUES.

Sardines, like other fish, are excellent food. One could replace all other meats in one's diet by sardines every day in the year and be just as healthy, because they contain as much body-building material and are as readily digested as their more expensive rivals.

A list is given below of important food products having high protein content. The current price of these articles and the food value per pound of each as purchased are included. The food value of the amount of each article which can be purchased for twenty-five cents is given in the last column.

Comparative Costs and Food Values of Some Common Sources of Protein.[1]

Food	Current price	Food value per pound as purchased	Food value purchased for 25 cents
Sirloin steak	35 cents per pound	975 calories	698 calories
Mutton, leg	35 cents per pound	890 calories	636 calories
Ham, fresh	40 cents per pound	1,320 calories	825 calories
Veal, cutlets	40 cents per pound	745 calories	465 calories
Eggs	50 cents per dozen	635 calories	423 calories
Milk, whole	14 cents per quart	310 calories	1,107 calories
Cheese, full cream	30 cents per pound	1,885 calories	1,566 calories
Chicken, broiler	60 cents per pound	289 calories	120 calories
Baked beans, canned	15 cents per 11-ounce can	555 calories	678 calories
Halibut, steak	25 cents per pound	475 calories	475 calories
Salmon, canned	25 cents per No. 1 can	915 calories	858 calories
Tuna, canned	35 cents per No. 1 can	960 calories	643 calories
California sardines, "pound oval," 4 to 7 fat fish per can	25 cents per can	938 calories	880 calories
California sardines, "quarter oil"	20 cents per can	1,101 calories	275 calories

[1] From an unpublished table prepared by Mr. L. D. Elliott of the National Canners' Association Laboratory, San Pedro, California.

Examination of the table shows twenty-five cents to have higher purchasing value for cheese and milk than for "pound oval" sardines. For other articles its purchasing power is lower. "Quarter oil" sardines are even higher in food value per pound than "pound oval" sardines, but they are more expensive. Anyway, they are hardly comparable with the other foods listed as they are classed more as a delicacy than as a staple article of food.

In considering food values it is important to realize that canned sardines are especially high in mineral constituents. Few foods have as high edible content of phosphates and lime as they have. For "pound oval" sardines this value is around two per cent.[1]

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[1] From analyses made by the author in the Preservation Laboratory, Fish and Game Commission of California, San Pedro.

INSPECTION IN THE SOUTHERN CALIFORNIA FISH CANNERIES.

NORMAN HENDRICKSON, Director, Southern California Fish Investigations, National Canners' Association.

Four years ago in November the fish canners in southern California entered into an agreement with the National Canners Association by which the canners volunteered to submit to a systematic investigation and to abide by rules and regulations to be provided by the association, the cost to be paid by assessment on the cans at the time of purchase. The original contract was for a period of three years. This has expired and a new one has been executed which terminates December 31, 1922. It seems probable that the inspection service will become a permanent institution but that its functions and methods of operation may be varied from time to time to suit the constantly changing business conditions of the industry. Though lacking the authority of a governmental agency, a private institution of this kind is unhampered by direct responsibility to the public and consequent red tape. It can act quickly in any emergency, and need not be as cautious about offering opinions or advice or risking errors in judgment, as is necessary in a public servant. It should be especially serviceable for trying out new projects which are not sufficiently conservative or safe, or which are too closely allied to private enterprise to be undertaken by any public or semi-public agency.

At the time the inspection was established the sardine and tuna industry was growing very rapidly on account of the stimulus given to food production as a war measure. This was responsible for the erection of a considerable number of new canneries and the operation of some of them by men lacking in experience in the canning of sardines and tuna and unfamiliar with the principles involved. The demand for fish was so keen that the fishermen were having things more or less their own way. Prices were advancing and some canners had become rather careless about the quality of fish accepted for canning.

The scope of the inspection in the beginning included a close supervision of the fish from the arrival of the fishing boats until shipment of the final product, and sometimes even further. Every load of fish on arrival at a cannery was carefully examined and passed upon by a competent inspector before acceptance by the buyer. A number of loads were condemned and diverted to reduction plants at a lesser price than would have been paid had they been accepted for canning. This, of course, led to some wrangling and ill-feeling on the part of a few fishermen and inspectors, but the need for such measures was shortlived and all concerned are apparently agreed that they have been benefited by the resultant improvement in the quality of the pack. Excess supplies of fish at any cannery were diverted, whenever possible, to other canneries where there was a shortage, resulting in a considerable saving of food supply.

A close supervision was maintained over the processes involved in the canning, and over the sanitary conditions of the plants, the workers, and the product. A number of invitations have been issued to canners to clean up certain parts of their plants and equipment. A considerable number of changes in process have also been recommended. Both of the above have been, in all cases, promptly complied with.

A very complete chemical laboratory has been installed and a competent chemist employed. Samples of oils, sauces, and other materials used in sardine and tuna canning are examined before purchase by the canners. A considerable number of instances of adulteration and poor quality in the supplies have been discovered in time to prevent their use by the canners. The time of the chemist, when not employed in testing materials, is devoted to scientific investigation of questions constantly arising relative to canning or the preparation of by-products.

The authority conferred by the United States Food Administration was of very material assistance in enforcing the regulations at the beginning and very extensive use was made of it. Fortunately, before this authority was withdrawn the need for it had entirely disappeared. Both canners and fishermen took very kindly to the regulations as soon as they became familiar with, and accustomed to them.

The most friendly relations with local, state, and federal officials have been enjoyed at all times and have been a wonderful assistance in attaining the desired results without compromising these officials in any way in their official relations.

For two years samples were examined from the daily pack of each canner and certificates issued to such as met the requirements. This issuing of certificates has now been discontinued, partly on account of the expense involved in safeguarding the use of the certificates, partly because the improvement in the pack as a whole makes it less necessary, and partly because there is danger that the issuers of certificates may become partly responsible for the quality of the product. After very careful consideration, all interested are agreed that the responsibility for a product should rest solely upon the manufacturer.

On the whole those in charge of the inspection feel that they have accomplished fairly well the purpose for which the inspection was started. The canneries as a group are quite modern and though there is considerable room for improvement in many of them the state of California has good reason to be proud of them. The quality of the product, the appearance and sanitary condition of the canneries is unquestionably as good as any in the world.

The California sardines of "quarter-oil" size, that is, those packed in olive oil in the familiar small flat tins, lend themselves to the preparation of a very superior article, equal to, if not superior to the best packs of French sardines. The large "pound oval" size packed in various sauces makes an excellent and cheap article of food.

Constant improvements in the handling and packing of the product are being evolved through the enterprise of the canners and the investigations of the various agencies studying the problems of the industry.

NOTES ON THE SEA LIONS.

By Edwin C. Starks.

The sea lion rookery (breeding place) of Ano Nuevo Island seems to be increasing in size, or perhaps it would be better to say, regaining its former size. Whether this is a local or a general increase in number of the sea lions, I have no means of knowing at this time. Neither do I know whether or not this indicates a temporary condition of the rookery; a maximum number, perhaps, of a fluctuation that may have taken place at periods for years without having been commented upon.

An increase of one rookery need not at all indicate an increase among the sea lions in general. It is supposed that the animals always resort to the same rookery, coming back from year to year at the breeding season. If this be so, it would be reasonable to expect a protected rookery, such as Ano Nuevo is, to increase in size. Certain individuals that bear scars or other marks of identification have been observed to appear at the same rookery year after year.

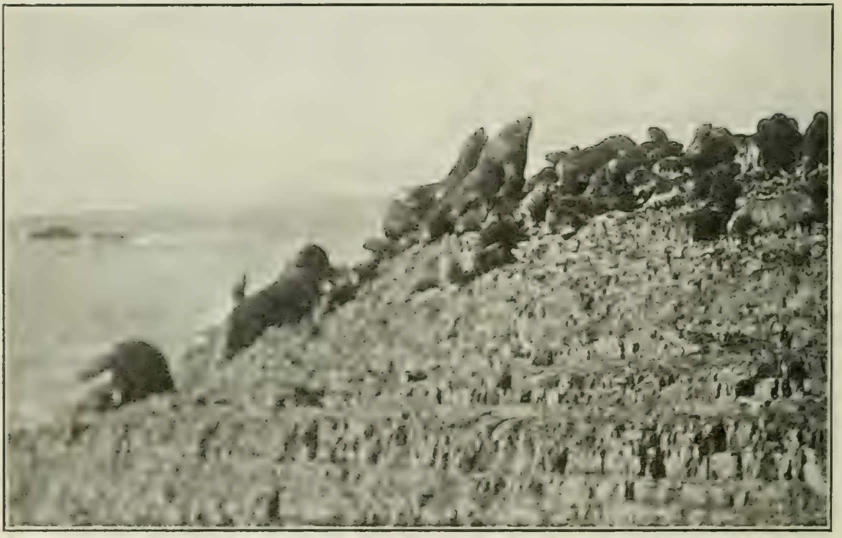

Fig. 85. Ano Nuevo Island rookery, showing cows and pups, Steller's sea lions. Photograph by Edwin C. Starks.

As further proof of this, and showing what may happen to an unprotected rookery, the conditions of some of the California sea lion rookeries may be cited.* On some of the Santa Barbara Islands several years ago the sea lions, at least the young, were killed for their skins. Sealers landed at the rookeries and clubbed the pups. The most accessible rookeries rapidly grew smaller from year to year, and at last completely ceased to exist as rookeries.

The number of young ('pups') indicate the size of the rookery. Each female ('cow') of breeding age has a single pup each year. Hence

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(*Ano Nuevo Island is a rookery of Steller's sea lion.)

each pup on the rookery represents a breeding cow. Each male ('bull') has a 'harem' of from 3 to 18 or 20 cows, or an average, perhaps, of 8 or 10. So by counting the pups on a rookery the size of the rookery may be ascertained with considerable accuracy. This, however, does not take into consideration a more or less indefinite number of individuals not yet breeding ('virgins' and 'bachelors') that are always to be found about the edges of the rookery. But however accurately the number of pups may indicate the entire size of the rookery, they certainly may be used as an accurate index to the fluctuations in size of the rookery. As the pups, until they are a month or six weeks old, do not leave the rookery when the adults are frightened away, they may be counted with considerable ease and exactness.

I spent several days at various times on the Ano Nuevo rookery in the years 1901 and 1902. The rookery was then confined to either one of two outlying rocky islets, known as Flag Rock and Sea Lion Rock, respectively. It was then a rookery of about 150 pups. Stories were current, however, of how in former years the rookery was much larger and not only covered the two outlying rocks, but also a part of the main island.

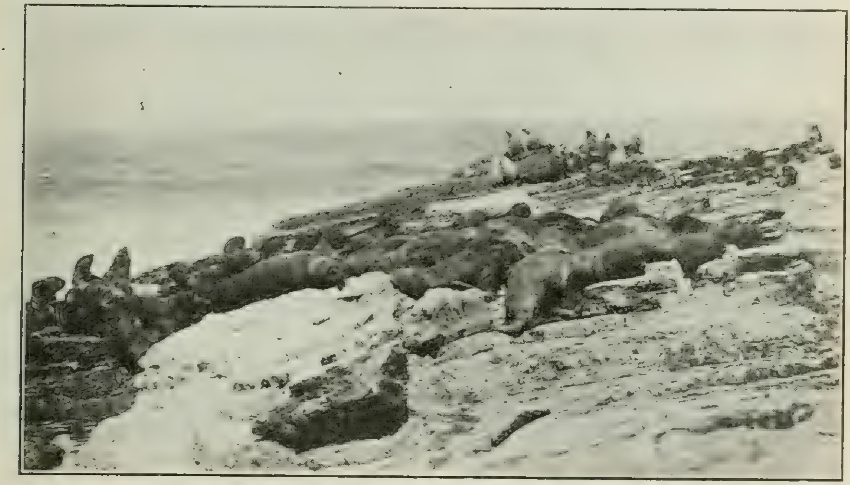

FIG. 86. Steller's sleeping pups. Adults in the distance. Ano Nuevo Island rookery. Photograph by Edwin C. Starks.

I recently (June 25, 1921) visited the island and found the latter condition. Both Flag and Sea Lion rocks were occupied and there was a considerable overflow onto the main island. I was informed that the number of pups at the last count (last year) was about 500.

The desirability of thinning out the sea lions is being continually brought up by the fishing interests. Before such a course is thought of, it should be ascertained with great certainty whether the sea lions are increasing or diminishing in number. Even if an increase is found, it should be made certain that it does not indicate a more or less normal fluctuation. If it can be proved that there is a steady increase, the animals may well be kept down to reasonable numbers.

This may most easily be done by killing a predetermined number of the pups on the rookery and carefully watching results. Shooting the adults from a boat when they are in the water is uncertain, cruel and wasteful. One never knows the percentage of wounded animals, for when shot they usually sink at once. The young nurse for the greater part of the year, so killing a cow usually means the slow starvation of her pup. In killing the pups on the rookeries the skins may be saved.

If nearly any sort of animal were thinned in number, one might naturally suppose that, if there were left a few of each sex of that animal, it would in time increase until it regained its former number. Such does not always appear to be the case. Often when an animal reaches a certain low level in number, it seems unable to recover, but becomes extinct. Hence the question of thinning out the sea lions should be approached with extreme caution. There is an intricate balance maintained between animals that seldom can be disturbed with impunity. Aside from purely sentimental reasons for wishing to preserve the sea lions on our coast, it may develop in time that they have as much value as many other products of the fisheries.

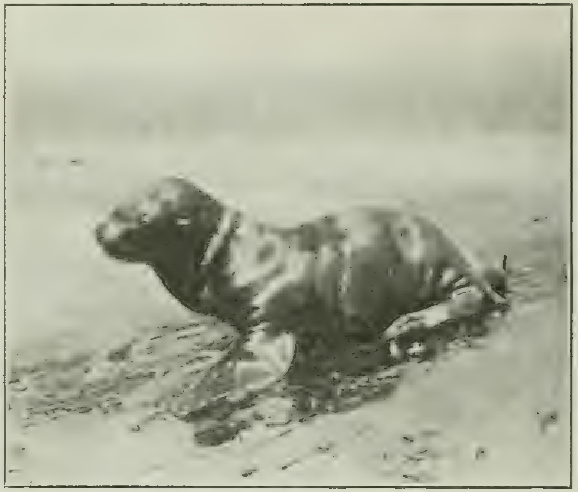

FIG. 87. Steller's sea lion, after being frightened from the rookery, Ano Nuevo Island. Photograph by Edwin C. Starks.

It may be pointed out in this connection that the cormorants, shearwaters and other sea birds, keep themselves pretty well gorged with fishes. As there are thousands of these birds along the coast, the total number of pounds of fishes per year that they consume must amount to considerable. But no one, I hope, will want to, or be allowed to, kill the sea birds on this account. The leopard seal is surely equally as great a fish eater as the sea lion, as are also the several porpoises. Sharks, too, may well cause much of the damage that the sea lions are blamed for. Lastly, destructive methods and waste in the fisheries may well receive consideration for depleted fisheries.

The sea lions of both species deserve study. A census should be made of the rookeries from year to year. Though the number of pups on the California rookeries indicates the number of sea lions on the coast at the breeding season, it is not at all certain that it indicates the number for all of the year.

Steller's sea lion breeds from the Santa Barbara Islands northward into the Arctic Ocean. The California sea lion breeds from the Santa Barbara Islands southward to some point on the Mexican coast. It is supposed that there is considerable migration among them, but there is no very good direct evidence of this. It may be, for instance, that the animals from Alaska spend a part of the year on the California coast. At any rate it is known that the California sea lion, that does not breed north of the Santa Barbara Islands, migrates at least as far north as the Columbia River.

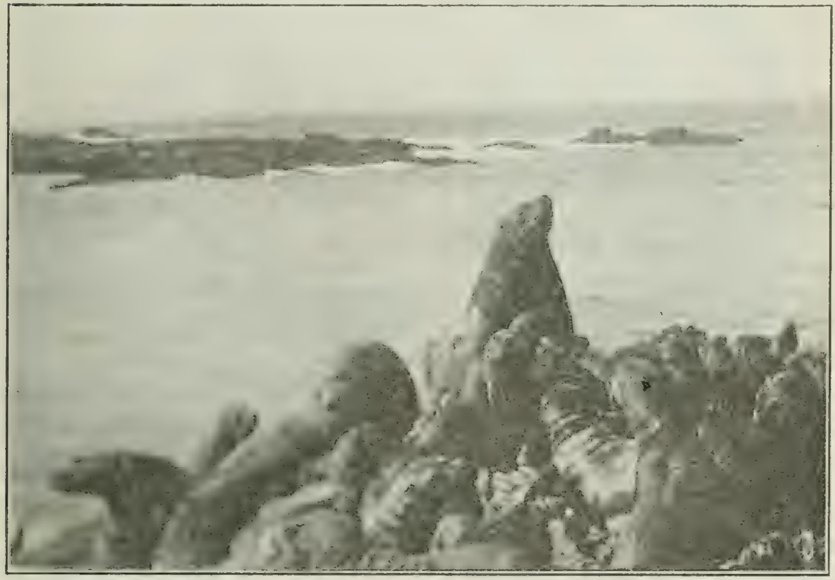

FIG. 88. Steller's cows and pups on Ano Nuevo Island rookery. Photograph by Edwin C. Starks.

The fur seals, that are rather closely related to the sea lions, breed only in the Arctic Ocean, but they migrate southward along our coast, and have been killed in former years on our mainland, and within my own memory on the Santa Barbara Islands. As the sea lions have many of the habits of the fur seals, we may argue that they, too, migrate from the place they were born. We do not know how far north the California sea lion extends its range, nor how far south Steller's sea lion goes.

Though a census of the California rookeries may not show the number of sea lions that may visit the coast, nevertheless such a record should be kept from year to year if only to show the number born on the coast and to preserve important data for future study of the life history of the animals.

Pups should be marked or branded with a distinctive mark for each rookery, and records made of the subsequent movements of such marked individuals. Thus it may be known whether animals born on one rookery ever breed on other rookeries. By this means, also, the extent of migrations could in time be learned. By a system of marks changing from year to year, the approximate breeding age as well as the entire age could be ascertained.

A DISTRIBUTIONAL NOTE ON HALIOTIS.

By S. Stillman Berry.

In his useful paper on "The Abalones of Northern California," in Volume 6 of this journal, Thompson ('20, pp. 45, 50), while recording the northern green abalone (*Haliotis walallensis* Stearns) from Monterey, a station which a small, rather poor specimen in my own collection apparently confirms, is inclined to reject the Alaskan white abalone (*H. kamtschatkana* Jonas) from the California list. However, a small form of it does undoubtedly occur at least as far south as Monterey Bay. Cooper, who states that he picked up a single dead shell on the beach at Monterey, affirmed this half a century ago ('70, p. 61), while another dead shell dredged by me in 15 fathoms, off Monterey, in 1906, was recorded some years ago (Berry, '07, p. 46) as *H. gigantea*, authorities differing then, as they still do, as to whether *kamtschatkana* and *gigantea* are practically separable. Present reexamination of the specimen does not cause me to alter this opinion of its identity.

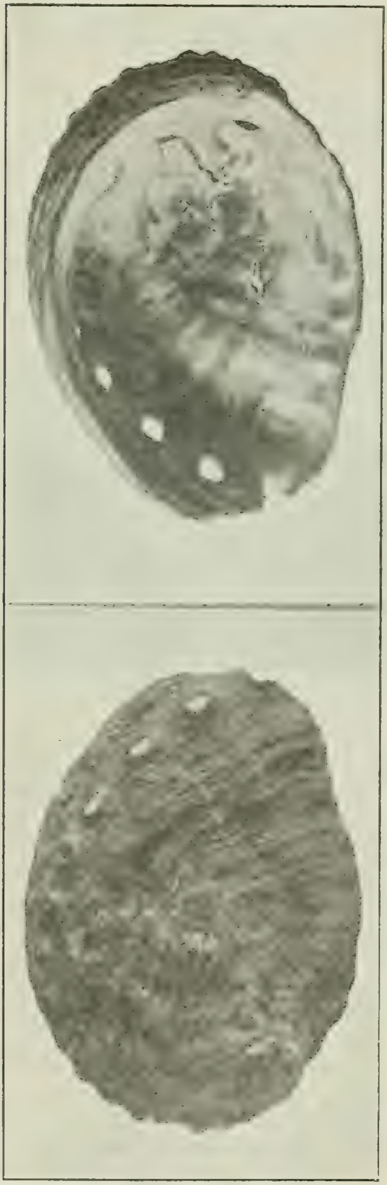

Fig. 89. *Alaskan white abalone* (*Haliotis kamtschatkana* Jonas), from Monterey Bay, California. Natural size. Photographs by S. S. Berry.

On a recent visit to Monterey, Mr. Carl Dolter showed me a small series of dead abalone shells which he had picked up along the sandy shore just north of Del Monte. All proved to belong to this northern species. One of these, which Mr. Dolter kindly gave me, and which is here figured for the sake of completing the valuable series of illustrations given by Thompson, is practically perfect, and measures, length 61.5, width 44.0, height (est.) 17 mm. None of the specimens is in any way commensurate with the ordinary Alaskan examples. *H. kamtschatkana* is far and away the smallest known species of California abalone.

Other authorities to record the Alaskan white abalone from Monterey have been Carpenter ('64, p. 541) and Campbell ('91, pp. 103, 104). Quite recently Dall ('21, p.

184) has recorded *H. kamtschatkana* from as far south as Redondo, but throughout this paper credence is unfortunately given to many poorly authenticated or doubtful extensions of geographic range, so that even where they seem perfectly reasonable, it would be easy to show too much precipitance in copying them until the supporting data can be placed on record.* Incidentally it may well be mentioned that the taxonomic recognition of no less than twelve Californian abalones in this paper is a little misleading to the general reader, for at least two of the subspecies of *H. crachcrodii* there recognized are based upon characters which seem certainly pathologic (*holzneri* Hemphill and *imperforata* Dall), while the other two are likewise of extremely uncertain value racially. Eight distinct forms of *Haliotis* is the only safe maximum we can claim at the present time.

H. kamtschatkana has figured but scantily in the literature of our fauna, and although by no means the rarest, is one of the least known of all our species. By all odds the best available account of it is that of Thompson (:14), which concerns itself mainly with the economic aspects of this mollusk in British Columbia. Over much of the western coast of North America it is the only discovered species of abalone.

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*Carpenter's record of the species from "near San Pedro" ('64, p. 541) is equally doubtful, but perhaps can never be certainly confirmed or rejected. His record of it from the Farallone Islands (op. cit., p. 651) is probably safer.

LITERATURE.

Berry, S. S.

'07. Molluscan fauna of Monterey Bay, California.
Nautilus, v. 21, pp. 17-22, 34-35, 39-47, 51-52, June-September, 1907.

Campbell, J. H.

'91. Mollusca of the United States. (Family *Haliotidae.*)
Nautilus, v. 4, pp. 101-104, January, 1891.

Carpenter, P. P.

'64. Supplementary report on the present state of our knowledge with regard to the Mollusca of the West Coast of North America. Report British Association Advancement Science, 1863, pp. 517-686, August, 1864.

Cooper, J. G.

'70. Notes on Mollusca of Monterey Bay, California.
American Journal Conchology, v. 6, pp. 42-70, July, 1870.

Dall, W. H.

'21. Summary of the marine shellbearing mollusks of the northwest coast of America, from San Diego, California, to the polar sea, mostly contained in the collection of the United States National Museum, with illustrations of hitherto unfigured species. United States National Museum Bulletin 112, pp. 1-217, pl. 1-22, 1921.

Pilsbry, H. A.

'90. *Haliotidae.* In Man. Conch., (1), v. 12, pp. 72, etc., 1890.

Thompson, W. F.

'14. Report on the abalone of British Columbia (*Haliotis gigantea*, Chemnitz.). Report British Columbia Commissioner Fisheries, 1913, pp. R 126–R 130, pl. 1, 1914.

'20. The abalones of northern California. California Fish and Game, v. 6, pp. 45-50, April, 1920.

A SELECTED BIBLIOGRAPHY OF CHEMICAL LITERATURE PERTAINING TO THE FISH INDUSTRY.

By Harry R. Beard, Preservation Laboratory, Fish and Game Commission of California, San Pedro, California.

This laboratory's cooperation with the California fishing industry has shown the need of a selected list of recent references for chemists in this industry who have neither the time nor facilities for making an exhaustive search of the literature bearing on their work. The following list was assembled as an endeavor to meet this need and to furnish a foundation for a more complete working bibliography. It is hoped that publication will extend its usefulness. The references cited were selected from a much larger list collected in a search of Chemical Abstracts, U. S. Bureau of Fisheries' publications, reference works and papers on the subject. The attempt was made to cite only a very few articles which appear in standard reference works or which appear in bibliographies given as a part of articles listed here. The publications of the U. S. Bureau of Fisheries have purposely been omitted, except in a few instances. The annual reports of the Commissioner of Fisheries contain a wealth of excellent material, any part of which can now be found easily by consulting the subject index, the title of which is given as the last reference in the list.

Although prepared primarily for technical men, the list will be found to be equally useful to others.

The importance of the foreign references, coupled with the lack of American articles, made their inclusion advisable.

Much credit is due Mr. Harden F. Taylor of the U. S. Bureau of Fisheries, Washington, for his criticisms and additions.

A. Examination of Fish (Chemical and Bacteriological).

"Tin salts in canned foods of low acid content, with special reference to canned shrimp." W. D. Bigelow and R. F. Bacon. U. S. Department of Agriculture, Bureau of Chemistry, Circular 79 (1911).*

"Preparation of the cod and other salt fish for the market. Including a bacteriological study of the cause of reddening." A. W. Bitting. U. S. Department of Agriculture, Bureau of Chemistry, Bulletin 133.

"Bacteriology of swelled canned fish." W. Sadler. Interim report, Biological Board of Canada (1916-1917); through Abstracts of Bacteriology, 1 (1917), 329-30.

"The examination of canned salmon for bacteria and tin." L. D. Bushnell and C. A. A. Utt. Journal of Industrial and Engineering Chemistry, 9 (1917), 678–79.

"Examination of fish." P. K. W. Bokman. Tidsskrift for Kemi, 15 (1918), 64–7.

"An aerobic spore-forming bacillus in canned salmon." A. C. Hunter and C. Thom. Journal of Industrial and Engineering Chemistry, 11 (1919), 655–7.

"A study of some chemical changes in oysters during their preparation for the market." Edward E. Smith. U. S. Department of Agriculture, Bulletin 740 (1919).

"A study of the microorganisms found in merchantable canned foods." E. W. Cheyney. Journal of Medical Research, 40 (1919), 177–97.

"A bacteriologic study of sardines." Maud M. Obst. Journal of Infectious Diseases, 24 (1919), 158.

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*The name of the article is given in quotations followed by the author's name, the name of the publication, the volume number and year and then the page numbers.

Allen, "Commercial organic analysis," 4th Ed.

"Bacterial decomposition of salmon." Albert C. Hunter. Journal of Bacteriology, 5 (1920), 353–61.

"Some considerations concerning the salting of fish." Donald K. Tressler. U. S. Bureau of Fisheries, Document 884 (1920).

"A pink yeast causing spoilage in oysters." A. C. Hunter. U. S. Department of Agriculture, Bulletin 819 (1920).

Leach, "Food inspection and analysis." 4th Ed., 1920, pp. 259–65.

Association of Official Agricultural Chemists, "Official and tentative methods of analysis of the Association of Official Agricultural Chemists," 1920.

"Principles involved in the preservation of fish by salt." Harden F. Taylor. Proceedings of the American Fisheries Society (1920), 120–52.

"Maine sardine industry." F. C. Weber, H. W. Houghton and J. B. Wilson. U. S. Department of Agriculture, Bureau of Chemistry, Bulletin 908 (1921).

B. Composition and Food Value of Fish.

"The commercial fish foods." J. Wittmann and R. Wunch. Oesterreichische Fischereizeitung, 7.

"Cooking and chemical composition of some English fish." K. I. Williams. Chemical News, 104 (1914), 271–4.

"Fish flesh." C. Ulrich. Archiv der Pharmazie, 249, 68–92.

"Utilization of fish muscle as compared to that of beef and the action of fish muscle on the composition of urine." B. Slovzov. Zentralblatt für Biochemie und Biophysik mit Einschluss der theoretischen Immunitätsforschung, 10, 511; Zeitschrift für physikalische und diätetische Therapie, einschliesslich Balneologie und Klimatologie, 14, 22.

"Fish sperm as food for man." J. Koenig and J. Grossfield. Biochemische Zeitschrift, 54, 333–50.

"Fish roe as food for man." J. Koenig and J. Grossfield. Biochemische Zeitschrift, 54, 351–94.

"Copper content of green oysters." Julius Nelson. New Jersey Agricultural Experiment Station Record. Annual Report. Vol. 36 (1915), 246–9.

"'Stockfisch,' 'Klippfisch' and 'Salzfisch.'" P. Buttenberg and L. van Noel. Zeitschrift für Untersuchung der Nahrungs—und Genussmittel sowie der Gebrauchsgegenstände, 30 (1915), 1–15.

"Experiments on the digestibility of fish." A. D. Holmes. U. S. Department of Agriculture, Bulletin 649 (1918).

"The nutritive value of certain fish." J. C. Drummond. Journal of Physiology, 52 (1918), 95–109.

"A chemical study of food fishes. The analysis of twenty common food fishes with especial reference to a seasonable variation in composition." E. D. Clark and L. H. Almy. Journal of Biological Chemistry, 33 (1918), 483–96.

"The value of the herring as food." C. J. A. Nature, 102 (1918), 6–7.

"Zinc in oysters." R. S. Hiltner and H. J. Wichman. Journal Biological Chemistry, 38 (1919), 205–21.

"Yields in tuna canning." D. B. Dill. Pacific Fisherman, 19 (1921), No. 2, 43 and 56–7.

C. Preservation of Fish (Canning, Refrigeration, Salting, Smoking, Etc.).

"Notes on the investigation of preserving fish by artificial cold." J. M. Battemanne. Preliminary Report, etc., Third International Congress of Refrigeration, Chicago, 1913. 48 pp. (The Netherlands.)

"Hydrolysis of fish gelatin." Y. Okuda. Journal of the College of Agriculture, Imperial University of Tokyo, 5 (1916), 355–63; Journal of the Society of the Chemical Industry, 36 (1917), 513.

"Canned crab." Okuda and Matsui. Journal of the College of Agriculture, Imperial University of Tokyo, 4 (1916), 325–37.

"The conservation of fish by freezing methods." R. Plank, E. Ehrenbaum and K. Reuter. Abhandlungen zur Volksernährung. Zentral-Einkaufsgesellschaft, Heft 5 (1916), 248 pp., Berlin.

"Shrimp: handling, transportation and uses." E. D. Clark, L. McNaughton and M. E. Pennington. U. S. Department of Agriculture, Bulletin 538 (1917).

"The influence of the rate of freezing upon the histological changes in animal tissues." R. Plank. Zeitschrift für Allgemeine Physiologie, 17 (1918), 221–38.

"Sea-mussels and their preparation for food." P. Buttenberg and L. van Noel. Zeitschrift für Untersuchung der Nahrungs—und Genussmittel sowie der Gebrauchsgegenstände, 36 (1918), 1-15.

"The histological changes in frozen fish and the alterations in the taste and physiological properties of their flesh." Journal of Hygiene, 17 (1918), 55–62.

"Formation of ammonia and amines in canned sardines during storage." F. C. Weber and J. B. Wilson. Journal of Industrial and Engineering Chemistry, 11 (1919), 121–6.

"Low temperature vacuum dehydration." K. G. Falk, E. M. Frankel and R. H. McKee. Journal of Industrial and Engineering Chemistry, 11 (1919), 1036–40.

"Fish-puddings, fish-dumplings, fish-sausage and similar preparations." P. Buttenberg, J. Angerhausen and L. van Noel. Zeitschrift fur Untersuchung der Nahrungs—und Genussmittel sowie der Gebrauchsgegenstände, 38 (1919), 145–53.

Cobb, "Canning of fishery products." 1919.

"Some considerations concerning the salting of fish." Donald K. Tressler. U. S. Bureau of Fisheries, Document 884 (1920).

"Report of experiments on the cold storage of herring carried out at North Shields." Ione H. Green. Department of Scientific and Industrial Research, Food Investigation Board (Great Britain). Memoir No. 11 (1920), 6 pp.

"Heat penetration in processing canned foods." W. D. Bigelow, G. S. Bohart, A. C. Richardson and C. O. Ball. National Canners Association, Bulletin 16–L (1920), 128 pp.

"The food of the small sea herring and ammonia and amines as end products of its decomposition." F. C. Weber and J. B. Wilson. Journal of the American Chemical Society, 42 (1920), 841–9.

"Chemical study of frozen fish in storage for short and long periods." E. D. Clark and L. H. Almy. Journal of Industrial and Engineering Chemistry, 12 (1920), 656–63.

"Interim report on methods of freezing fish, with special reference to the handling of large quantities in gluts." Department of Scientific and Industrial Research, Food Investigation Board (Great Britain). Special Report No. 4 (1920), 40 pp.

"Principles involved in the preservation of fish by salt." Harden F. Taylor. Proceedings of the American Fisheries Society (1920), 120–52.

"The Maine sardine industry." F. C. Weber, H. W. Houghton and J. B. Wilson. U. S. Department of Agriculture, Bureau of Chemistry, Bulletin 908 (1921).

D. Oil from Fish (Preparation, Examination, Composition and Uses).

"A critical study of the natural changes occurring in fats and oils." J. S. Hepburn. Journal of the Franklin Institute, 168 (1909), 365–84 and 431–56; 169 (1910), 22–54.

"Fish oil as a paint vehicle." M. Toch. Journal of Industrial and Engineering Chemistry, 3 (1911), 627.

Lewkowitsch, "Chemical technology and analysis of oils, fats and waxes." 5th Ed., part II, 1914, pp. 405–72; part III, 1915, pp. 411–12.

"Fish oil stearin and olein." M. Tsujimoto. Journal of Chemical Industry (Japan), 18 (1915), 1062–72.

"Utilization of fish oils and by-products fat in the soap, stearin and fatty acid industry." C. H. Keutgen. Seifensieder-Zeitung, 42 (1915), 552–3, 573–4, 594–5, 617–8.

"Chemical composition of fish oils (herring oil)." J. A. B. Svendsen. Tidsskrift for Kemi, Farmaci og Terapi, 13 (1916), 14–6; Journal Society of the Chemical Industry, 36 (1917), 657.

"Clarification plant for recovering fatty and other products from the waste waters of a fish cannery." J. Barth. Seifenfabrikant, 36 (1916), 833–6.

"The composition of cod liver oil." Henrik Bull. Tidsskrift for Kemi, Farmaci og Terapi, 14 (1917), 1–2.

"Whale oil: how it is graded and tested." Anon. Oil, Paint and Drug Reporter, 91 (1917), No. 22, 57.

"The composition of Menhaden oil fatty acids." E. Twitchell. Journal of Industrial and Engineering Chemistry, 9 (1917), 581–4.

Fryer and Weston, "Oils, fats and waxes," I, 1917, pp. 96–109; II, 1918, pp. 132, 272 and 273.

"Process for deodorizing fatty oils." W. P. Schuck. Metallurgical and chemical Engineering, 18 (1918), 608–9.

"Liver oils from shark, ray, spear-fish and sword-fish, poulp and crab." Tsujimoto and Kobayashi. Journal of Chemical Industry (Japan), 22 (1919), 1058–64.

"Use of hydrogenated whale (blubber) oil as a food." H. Thomas and F. Muller. Zeitschrift für Untersuchung der Nahrungs—und Genussmittel sowie der Gebrauchsgegenstände, 38 (1919), 194–8.

"Fish oil and soy-bean oil as paint and varnish vehicles." W. G. Lahey. Drugs, Oils and Paints, 35 (1919), 183–7.

"Marine animal oils in paints and varnishes." H. A. Gardner. Paint Manufacturers' Association of the U. S., Circular 68 (1919).

"Notes on blubber type oils and their application." H. A. Gardner. Paint Manufacturers' Association of the U. S., Circular 74 (1919).

"Fish oils and the leather industry." Schlossstein. Journal of the American Leather Chemists' Association, 14 (1919), 41–9.

"Standard methods for the sampling and analysis of commercial fats and oils." W. D. Richardson, et al. Journal of Industrial and Engineering Chemistry, 11 (1919), 1161–8.

"The production of edible oils." Anon. Chemical Age, 28 (1920), 342–7.

"Oil extraction by electrolysis." Anon. Chemical Age, 28 (1920), 407–10.

"Tuna fish oil." H. A. Gardner. Paint Manufacturers' Association of the U. S., Circular 81 (1920).

"Yellowtail fish oil." H. A. Gardner and Arthur Reilly. Paint Manufacturers' Association of the U. S., Circular 86 (1920).

"Salmon fish oil." H. A. Gardner. Paint Manufacturers' Association of the U. S., Circular 92 (1920).

"Some applications of the sulphonated products of seed and fish oils." F. Scurti and A. Fubini. Stazioni sperimentali agrarie italiane, 52 (1920), 436–46.

"Squalene: A highly unsaturated hydrocarbon in shark liver oil." Mitsumaru Tsujimoto. Journal of Industrial and Engineering Chemistry, 12 (1920), 63–72.

Allen Rogers, "Manual of industrial chemistry," 3d Ed., 1920, pp. 666–74.

E. Meal from Fish (Preparation, Examination, Composition and Uses).

"Chemical detection of meat and bone meal in fish meal." F. Chrometzka. Zeitschrift für Öffentliche Chemie, 20 (1914), 88–90.

"The fish-scrap fertilizer industry of the Atlantic Coast." J. W. Turrentine. U. S. Department of Agriculture, Bureau of Soils, Bulletin 2 (1913).

"Utilization of fish waste of the Pacific Coast for the manufacture of fertilizer." J. W. Turrentine. U. S. Department of Agriculture, Bulletin 150 (1915).

"Composition of certain fish fertilizers from the Pacific Coast and the fertilizer value of degreased fish scrap." J. R. Lindemuth. Journal of Industrial and Engineering Chemistry, 7 (1915), 615–9.

"Fish meal: Its use as a stock and poultry food." F. C. Weber. U. S. Department of Agriculture, Bulletin 378 (1916).

"Fish wastes for feeding animals." J. M. Bartlett. Maine Agricultural Experiment Station, Bulletin 266 (1917), 291–2.

"Fish meal as feed for swine." F. G. Ashbrook. U. S. Department of Agriculture, Bulletin 610 (1917).

"Fish meal: Its composition and value as a feeding stuff for pigs, poultry, cattle and sheep." The Aberdeen University Press Limited. Aberdeen. 1917, pp. 3–6, 12–21.

"The fish by-products industry of the Pacific Coast." J. P. Kelly. Pacific Fisherman, 18 (1920), No. 12, 24.

"Suggestions to fish and meal producers." Anon. Pacific Fisherman, 18 (1920), No. 12, 54.

Gardner, "Papers on paint and varnish," 1920.

Allen Rogers, "Manual of industrial chemistry," 3d Ed., 1920, pp. 445–7.

"Yields in tuna canning." D. B. Dill. Pacific Fisherman, 19 (1921), No. 2, 43 and 56–7.

F. Miscellaneous.

"Fish rubber." F. Frank and E. Marckwald. Gummi-Zeitung, 26 (1912), 1498–9.

"Manufacture of artificial rubber from fish in Holland." Board of Trade Journal, June 6, 1912; Journal of the Society of Chemical Industry, 31 (1912), 595.

"Shark skin leather." Allen Rogers. Journal of the American Leather Chemists' Association, 13 (1918), No. 2, 528–30.

"Preservation of fish nets." Harden F. Taylor. U. S. Bureau of Fisheries, Document 898 (1921).

"An analytical subject bibliography of the publications of the Bureau of Fisheries, 1871–1920." Rose M. E. MacDonald. U. S. Bureau of Fisheries, Document 899 (1921).*

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*The Division of Fishery Products, U. S. Bureau of Fisheries, Washington, issues a series of memoranda on the capture, preservation and utilization of fishery products. These memoranda, copies of which can be obtained upon application, contain a wealth of information. Number S200 of this series gives the titles of the numbers issued to June 1, 1921.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

December 12, 1921.

A SARDINE NUMBER.

Commercial fisheries in California first came into prominence in early days with the salmon industry, which was the first fishing industry of any importance in the state. Then developed the tuna industry, and in the last few years the sardine industry has come to be recognized as the most important of the fishing industries. These fisheries mean an annual return to the state of many millions of dollars. The total pack of all varieties of fish canned in 1920 was about 1,941,984 cases. In view of the constantly growing value of these industries, and the part played by the Fish and Game Commission in their development, we are issuing this "Sardine Number." The excellent and well illustrated articles on the sardine industry, methods of catching and of canning, and of the various uses for these fish and their by-products, have been prepared by the staff of the State Fisheries Laboratory, and are designed particularly for those readers who are interested in fisheries in general. Nevertheless, they should prove of value to the trade because of statistics which appear in print for

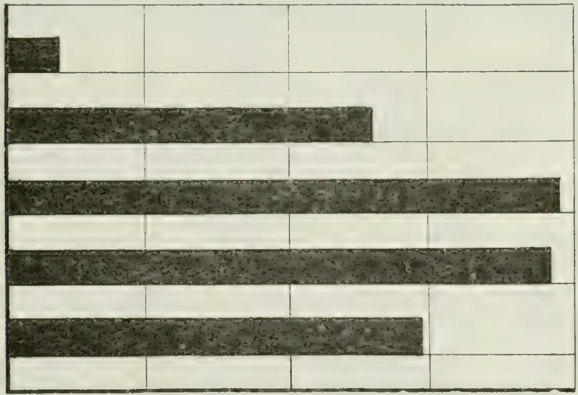

FIG. 90. Chart showing comparison of sardine catch in California, years 1916 to 1920. Prepared by S. H. Dado.

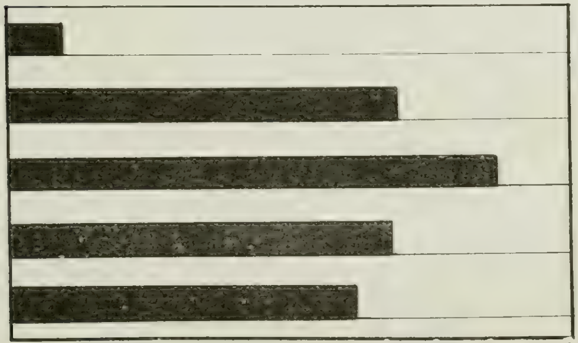

FIG. 91. Chart showing comparison of yearly production of California canned sardines. Phepared by S. H. Dado.

the first time. The accompanying diagrams (Figure 90 and Figure 91) will show the rapid growth of the industry, and the yearly production from 1916 to 1920.

COMPARISON OF SARDINE CATCH.

The United States Bureau of Fisheries has furnished us with a comparison of the output of the sardine fisheries of Maine, Norway, Portugal, and France, together with the relative number and value of the plants, the number of employees, the total quantity of fish caught, and the quantity of sardines caught, the quantity canned, and the value of the sardines. A glance at the following table, covering the year 1919, will show how the output and value of the California industry compares with that of the other countries:

Comparison of the Catch of Sardines for the Year 1919.

	California	Maine	Portugal	France	*Norway
Number of plants	41	[1]52			
Value of plants	$7,708,871	[2]$3,680,248			
Number of employees	8,242	5,457			
Quantities of fish, lbs.	262,260,000	[3]123,940,635			
Quantities of sardines, lbs.	153,880,000			[4]16,988	[5]185,515
Quantities canned, cases	2,071,641	2,426,132	[6]39,264		
Value of sardines	$11,813,156	$843,463	[7]21,329,695	[8]37,086	

*Commercial report, November 21, 1919 for 1916.

[1] Sardine plants.

[2] Sardine.

[3] Herring and sardines.

[4] Metric tons (16,718.83 long tons).

[5] Metric tons (182,575.55 long tons) exported.

[6] Tons.

[7] Escudos.

[8] Francs.

SUMMER RESORT EDUCATIONAL WORK, 1921.

Continued along the same lines as last year, the Yosemite Nature Guide Service reports increased interest on the part of the public and improved service rendered visitors to Yosemite National Park. That the Fish and Game Commission, cooperating with the National Park Service, has taken advantage of the opportunity to teach natural history and fish and game conservation to summer vacationists is evidenced by the following figures: Attendance at the 52 illustrated lectures and campfire talks given totaled 31,545. Attendance on the 105 field trips given totaled 2214. All day field trips numbered five. Innumerable questions were answered during the office hours. Increased interest in the field trips offered is reported, the numbers in attendance on several occasions exceeding fifty. Splendid opportunity of bringing home conservation lessons was afforded on the field trips by first hand study of trout, deer, tree squirrels, grouse, mountain quail, and band-tailed pigeons, as well as the common song birds. That this educational campaign will react favorably on the development of a useful sentiment as regards the conservation of natural resources, appears inevitable.

STATE FAIR EXHIBIT, 1921.

The general consensus of opinion by visitors to the State Fair (September 3–11) was that the Fish and Game Commission's exhibit was "the best thing on the grounds." It was so well advertised by enthusiastic visitors that practically everyone entering the gates saw the display. Three years ago the Commission installed a permanent exhibit consisting of a panorama of the Sierra Nevada showing three of the state's hatcheries in miniature and lighted in such a way as to give the changing colors of sunset, night and sunrise. Pleasing additions were made this year in the form of Mount Lassen in eruption and a small electric train that formed a special attraction to the children. The floor space was nearly doubled by the addition of a well arranged exhibit by the Commercial Fisheries Department. The increase in the fishing industry was graphically shown and fishery products of all kinds from abalones to tuna were on display. Equipment for whale fishing and abalone fishing were particularly enjoyed by the crowds, as

Fig. 92. Field study class in Yosemite, 1921. Nature walks are part of the summer resort educational program of the Fish and Game Commission. Photograph by H. C. Bryant.

were also the materials manufactured from kelp. Educational films shown twice daily attracted large crowds also. Through the medium of this exhibit many thousands of people have become intimately acquainted with the work of the California Fish and Game Commission.

HUNTING ACCIDENTS.

With the opening of the deer season came the usual number of hunting accidents. One San Francisco hunter was critically hurt in Trinity County when a companion mistook him for a deer, a professor at Stanford University was seriously wounded near Redding, and another man met death at the hand of his hunting companion near Gilroy under similar circumstances. Several other accidents of the same kind might be cited. There should be less danger in going hunting than in traversing rattlesnake country, and yet it is quite the reverse. It is very doubtful whether one man a year dies from the bite of a rattlesnake, and yet anywhere from five to fifteen hunters lose their lives annually. The only excuse that a hunter has who kills his companion is "carelessness," if that can be considered an excuse. Certainly it is not a satisfactory excuse! The spiked buck and doe law has been found helpful in decreasing hunting accidents. This is the state's contribution. The thing now needed is the following of the "look before you shoot" motto by the individual hunter.

PUBLIC SHOOTING GROUNDS.

The usurpation of most of the best wildfowl shooting grounds by gun clubs has caused increased demand for public shooting grounds. Although the desirability of such public shooting grounds appears to be admitted by both state and federal officials, the first real attempts to secure them have only recently appeared. Included in the New-Anthony bill is provision for the purchase, or rental, and maintenance of marsh and water areas especially suitable for migratory wild fowl, which shall be used as free public shooting grounds in the open hunting season and safeguarded as breeding and resting places for these birds in the close season; and second, the administration of the migratory bird treaty act in order more adequately to maintain and increase the supply of migratory birds, including not only the ducks, geese, and others classed as game, but the great host of smaller species which are so vitally essential to the agricultural interests of the country through their unceasing war on injurious insects.

The most needed step at present is the conservation and perpetuation of a sufficient number of small inland lakes, as well as inland and coastal swamp and marsh areas, to provide our migratory wild fowl necessary feeding, resting, and breeding places within the United States. Many of them should at the same time be set aside as public shooting grounds. Under proper conditions many lakes, ponds, swamps, and marsh areas will yield a distinctly larger return than would the same areas drained for agricultural purposes.

Louisiana is one of the first states to adopt the broad policy of protecting its citizens against monopolization of the desirable hunting grounds by exclusive clubs. In the setting aside of the Pass-a-l'Outre Public Shooting Grounds, a tract of 60,000 acres at the mouth of the Mississippi River, the first public shooting grounds have been established. Here the sportsman of moderate means can enjoy all the opportunities for wildfowl shooting enjoyed by wealthy members of the exclusive clubs in that region.

UNNATURAL NATURAL HISTORY.

Much of the misinformation which prevails among the general public can be traced to the false reports published in our prominent newspapers. We sometimes read of the attacks of mountain lions upon people passing their haunts; or of the attacks of eagles or other large birds upon children and grown people. These stories, when traced to their source, are usually found to be entirely without foundation of truth. Nevertheless, the prejudice left in the minds of those reading such stories is leading to the destruction of many of our large birds, which are fast disappearing and yet are a relatively harmless species.

For example, our attention was recently called to the following item, which appeared in the *Oakland Tribune* of June 8, 1921:

> EAGLE KILLS BOY WHO CLIMBS TREE TO LOOK AT NEST.
>
> (By Associated Press.)
>
> Ventura, Cal., June 8.—Juan Gonzales, 11, was killed by an eagle on a stock ranch twelve miles north of here last Sunday, it was announced in a report received today. The boy climbed a tree to look at the bird's nest and was attacked before he could escape. His skull was punctured in three places by the bird's beak.

After reading this item, Mr. Emerson A. Stoner, of Benicia, California, undertook an investigation of the story, and received the following letter from Mr. Lewis P. Hathaway, the Coroner and Public Administrator of Ventura County:

> Ventura, California,
> June 10, 1921.
>
> Mr. Emerson A. Stoner,
> Box 444, Benicia, California.
>
> Dear Mr. Stoner: Regarding the story of the horrible work of eagles in Ventura County, will say:
>
> On June 1, a Mexican employed on Ranch Sespe between Fillmore and Santa Paula appeared at the office of Dr. Merrill in Santa Paula with his little son who was ill; had been ill for some time. Dr. Merrill informs me that in taking the "history" of the case, he asked the parent or parents if the lad had suffered injury within the past few weeks. They said the only chance he had had of being injured was when he fell from a tree several weeks ago; blackbirds had flapped about his head when he attempted to interfere with their young, and, frightened, he had fallen a short distance.
>
> Dr. Merrill made an effort to locate bruises or breaks, but it was not until he had bathed the lad and shaved his head for the removal of cooties, that he could determine as to outward appearances; he informs me there were NO bruises and NO "holes in the skull," or even in the scalp, or indications that there had been any.
>
> The illness was then diagnosed as "peritonitis," because, the possibility of outward injury eliminated, this seemed the only result that could be arrived at.
>
> The lad died on June 2, and the death certificate was "peritonitis."
>
> All of these statements were corroborated by my deputy at Santa Paula, Mr. E. A. French, who is an undertaker. It had not occurred either to Dr. B. E. Merrill or undertaker E. C. French that there was necessity (?) for a notification

of the coroner until the newspaper at the county seat published the "eagle story."

A Spanish vaquero heard the blackbird end of the yarn, proceeded to imagine the wounds on the head, and the business manager for the vaquero's employer brought the embellished story to Ventura. It needed further embellishment and a willing newspaper reporter did the rest.

Interesting, isn't it?

The yarn was only a yarn.

Yours very truly,
(Signed) LEWIS P. HATHAWAY
Coroner.

MIGRATORY BIRDS IN LATIN AMERICA.

Dr. Alexander Wetmore, who has recently returned from a year's absence in Argentina, Paraguay, and Uruguay, has collected some valuable material regarding the status of the North American migratory birds in the countries which he visited.

Among the migratory birds which Dr. Wetmore found in South America was the barn swallow. Other species noted were shore birds which were observed in the marshy pampas or on the coastal mud flats: "Some were found to winter well north in the Tropics and others to travel as far south as the Straits of Magellan. Among our game birds seen in Argentina and elsewhere were the golden plover and pectoral sandpiper."—*Weekly News Letter*, United States Dept. Agr., August 3, 1921.

One of the objects of Dr. Wetmore's trip was to secure information regarding the possibility of arranging treaties with the South American countries for protecting migratory birds, similar to the Migratory Bird Treaty Act which the United States has with Great Britain. When we consider what the protection of migratory birds has accomplished in North America, as recognized by both scientists and sportsmen, we feel that it would be a splendid attainment if their protection could be further extended to this southern country.

RAINBOW TROUT ACCLIMATIZED IN AUSTRALIA.

As has been stated before in these pages, the rainbow trout has become well established in New Zealand and also in Australia. We present herewith (see Figure 93) some visible proof in the way of a photograph of a catch of rainbows made on the Deepwater River, New

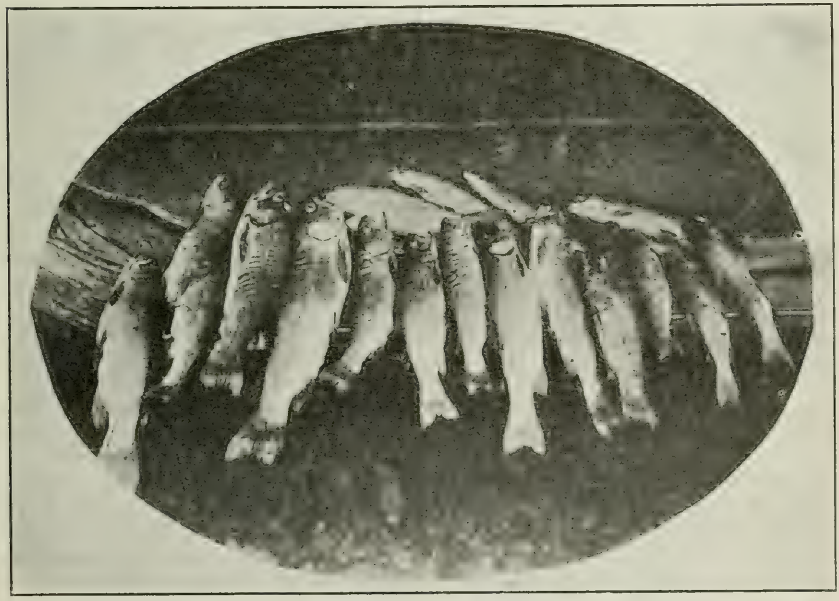

Fig. 93. Catch of Rainbow Trout made on Deepwater River, New South Wales, by Mr. J. S. Bacon. Photograph by J. S. Bacon.

South Wales. Mr. J. S. Bacon, who sends the photograph, states that the fish are doing well and breed successfully.

California's rainbow is now widely distributed over the world from Australia to the Argentine. The golden trout is now in demand and the question is: Shall we let the world have it or keep it a distinctive fish in California?

AUSTRALIA SEEKS INFORMATION ON FISHWAYS.

That Australia is confronting the same problem with reference to migratory fish occasioned by the development of irrigation systems that California successfully solved several years ago, is evidenced by the following letter received from Hon. F. Lewis, Chief Inspector of Fisheries and Game, Melbourne, Australia:

> From the frequent perusal of your splendid journal, "California Fish and Game," I note that the provision of fishways or ladders is compulsory in your state. Many large dams and weirs have been erected on our water courses during the last few years with a view to conserving water for irrigation purposes, and this work will probably extend very considerably in the near future.
>
> So far no fishways or passes have been erected on any of these weirs, although many of the streams are stocked with both brown and rainbow trout. In addition there are large numbers of native fish, mostly members of the perch family, in these waters. As it is very desirable to allow facilities for the natural movements of the fish, I shall be grateful if you can let me have full particulars of the law in operation in your state relating to the erection of fishways or ladders. I should also like to have any plans or photographs available of such works.
>
> Are the fish ladders only erected on streams where trout are found, or must they be placed on all waters irrespective of the class of fish contained therein?

Full details regarding legislation, construction and maintenance of fishways have been sent the Australian official.

NEW BIRD LAW PROHIBITS GUIDES FROM MAKING KILL.

A tendency to tighten the restrictions on the hunting of birds and big game is noted in the game laws for 1921, a summary of which, both federal and state, has been compiled by the Biological Survey of the United States Department of Agriculture, and published as Farmers' Bulletin 1235. Among the notable changes made during the present year was the amending of the Migratory Bird Treaty Act regulations with respect to bag limits.

This amendment provides that the daily bag limit of any person shall now include "all birds taken by any other person who for hire accompanies or assists him in taking migratory birds." This will put an end to the abuse of privileges under the regulations regarding the prescribed daily bag limits by persons who claim that birds were killed by guides accompanying them.

The federal waterfowl season for California was fixed from October 1 to January 15, replacing the old season of October 16 to January 31, the season now being the same under both federal and state laws. Regulation 9, governing the issuance of federal scientific permits, was amended to permit the issuance of limited and special permits.

State legislation harmonized federal and state laws on waterfowl and shore birds in Kansas and Oregon, and on waterfowl in Pennsylvania and Rhode Island; Washington prescribed a statewide open season on all migratory game birds from October 1 to January 15, thus deviating from the federal regulations, which supersede the state law, east of the Cascade Mountains, where it will now be possible to hunt migratory game birds only from October 1 to December 31, without violating either federal or state law; in Idaho the open season on migratory game birds has been shortened under state law two weeks by opening October 1, instead of September 16, and extending to December 31.

Idaho, Kansas, Montana, Nebraska, Oregon, and Washington enacted legislation similar to the federal regulation prohibiting hunting from airplanes. Colorado reduced the bag limit on ducks from 20 to 15 a day, while Kansas increased the limit from 20 to 25. In New Jersey reedbirds were protected at all times by being placed in the nongame class. The open season for woodcock was shortened 25 days in Michigan, two weeks in New York, and one month in Vermont. Doves were protected until

1924 in Colorado, and in Kansas an open season on them was provided from September 1 to October 15.

In general, seasons on big game were shortened and hunting further restricted. Buck laws were enacted in Michigan, Montana, Nevada, North Dakota, South Dakota, Vermont, and in Washington east of the Cascades. Maine protected spike bucks and prescribed that one of the two deer allowed in the eight northern counties must be an antlered buck, and provided that in two of the counties only residents may hunt deer during the last two weeks of the open season. Bull moose were protected for five years in Maine.

The summary of the laws contains the provisions relating to seasons, licenses, limits, possession, sale, and export, thereby furnishing the reader a brief and convenient synopsis of the laws of each state, territory, or province of Canada. The migratory bird treaty, the treaty act, and regulations, as well as the Canadian regulations also are appended. Copies of the bulletin, Game Laws for 1921, may be had free upon application to the United States Department of Agriculture, Washington, D. C.

WIRE HALTS BEAVER.

A barbed wire entanglement which will keep beavers from destroying property and constructing dams has been tried out by the state fish and game authorities at the A. M. Kischir ranch in the Shields valley with so much success that it is believed that it will no longer be necessary to grant any considerable number ot permits to kill beaver in Montana.—*Billings Gazette*, July 15, 1921, Montana.

A SEA ELEPHANT NEAR SAN CLEMENTE.

The issue of *The Catalina Islander* of September 20, 1921, records the occurrence of a sea elephant between San Clemente and Catalina Islands on September 10, by Captain Hugh MacKay, Mr. Mankowsky and party in the launch Manana. Two interesting photographs are shown.

FACTS OF CURRENT INTEREST.

The Fishcultural Department reports that the past year has been a most successful one. Of trout fry alone there were reared and planted nearly 25,000,000.

* * *

An old violator was caught with 28 ducks during the early part of September, by Deputy Carpenter. A stiff jail sentence followed.

* * *

The Sacramento office has made several Greeks and other aliens put a higher valuation on citizenship by haling them into court on their failure to produce citizenship papers, although carrying resident hunting and fishing licenses.

* * *

The Fish and Game Commission's exhibit at the State Fair, during the first week in September, attracted wide interest. The usual display of golden trout was made, no difficulty being found in keeping these beautiful fish on display.

* * *

During the summer more than 31,000 persons heard lectures and campfire talks on wild life and its conservation in Yosemite National Park and more than 2000 availed themselves of the opportunity to go afield under a nature guide.

* * *

The kelp industry, which grew to importance during the war, is now a memory, all the plants having closed down.

NOTES FROM THE STATE FISHERIES LABORATORY.

Will F. Thompson, Editor.

THE NEW LABORATORY.

This month, September, sees the practical completion of the new laboratory, regarding which an article appeared in the last issue of this magazine. It promises to exceed all our expectations in beauty and convenience, although not too large for efficiency. It is fully expected that the middle of October will see us installed in our new quarters.

THE ALBACORE SEASON.

The albacore season has been unexpectedly successful, there having been taken, according to recent estimates, nearly eight thousand tons. Considering the lateness of the start, which was due to difficulties over price, the catch has been relatively successful. The season has been characterized by a remarkably late run at the Coronado Islands.

At the present writing considerable numbers of yellow-finned tuna and skipjack have appeared. Also numbers of the smallest year group of albacore have been taken, as was the case last year. But no frigate mackerel, dolphins or other unusual fish have come into the wharf as yet. And above all, the blue-fin tuna have been noteworthy for their absence, where in previous years so many have been taken.

THE LABORATORY STAFF.

During the past three months Mr. Sette and Mr. Holmes have both been at San Pedro, but leave September 26 for Monterey, whence they go to Stanford University on the twenty-ninth for the fall term there.

Dr. Tage Skogsberg has been employed to take Mr. Holmes' place during the coming year. Dr. Skogsberg is a graduate of Upsala University, Sweden, and came to this country in order to pursue his studies on ostracods. After residence for some time at Hopkins Marine Station, at Pacific Grove, he sought permanent employment in this country, rather than to return to Sweden. The Commission was grad to obtain him, as men of his qualifications are hard to obtain.

In the place of Miss Helen Edwards, now Mrs. Bacon, whose marriage was chronicled in the last issue of this magazine, we have been fortunate in securing Miss Frances N. Clark. Miss Clark is a graduate of the Zoology Department of Stanford University and has had much experience in assisting Dr. C. H. Gilbert and others in their work on the salmon. She will have charge of the library work in the new laboratory, as well as assisting Mr. Thompson.

Mr. W. L. Scofield has been stationed at Monterey, as previously, carrying on the sardine investigations there.

Mr. Thompson and Mr. Higgins are at San Pedro in anticipation of the opening of the new laboratory. They attended the meeting of the American Association for the Advancement of Science, with which the Pacific Fisheries Society is affiliated, and Mr. Thompson read a paper on his albacore work.

THE SURF-SMELT, HYPOMESUS.

On June 28, Mr. Thompson visited Halfmoon Bay with Mr. Scofield and Mr. Dado, in order to study the run of the surf-smelt, *Hypomesus*. Unfortunately no smelt ran and inquiry was restricted to conversations with experienced fishermen and observation of the beaches on which they are said to run.

It is clear, however, that there are no grounds as yet for supposing that the species spawns on the beach, or even that it spawns in the surf. It is said to be found at irregular times, and sometimes on one beach, sometimes on another. The fishermen with whom we talked could not foretell in any way when a run would occur, and the fish were supposed to appear any time between April and September. The fact that they were usually taken on a beach with a net did not, of course, prove their absence on rocky shores.

The fishermen said anchovies were sometimes taken the same way, at night.

THE LIBRARY.

The California State Fisheries Laboratory has recently acquired the following complete sets:

Journal of the Marine Biological Association of the United Kingdom.

Report of the Lancashire Sea Fisheries Laboratory of the University of Liverpool.

Report of the Liverpool Marine Biological Committee.

Memoirs of the Liverpool Marine Biological Committee.

Transactions of the Liverpool Biological Society.

Meddelelser fra Kommission for Havundersogelser. Series: Fiskeri, Hydrografi and Plankton.

International Revue der gesamten Hydrobiologie and Hydrographie.

Norsk Fiskeritidende.

The Sea Fisheries. J. Travis Jenkins.

Publications of the Conseil Permament International pour l'Exploration de la Mer.

A NOTEWORTHY BOOK.

The library is recently in receipt of a volume, "The Sea Fisheries," by Dr. J. T. Jenkins. It describes the fisheries of England, their administration, methods and scientific investigations in as comprehensive a manner as possible within a good sized volume. It is carefully compiled, in a scholarly fashion, and the content is not marred by unduly emphasized viewpoints. The fact of depletion is stated with proper emphasis, and without distortion of evidence.

In only one particular does the author disappoint to a serious extent, and that is in his avoidance of critical treatment of research work, particularly other than England.

The book is decidedly necessary to any fisheries library, however limited in scope, and may be obtained from the author, 16 Walton's Parade, Preston, England, at 24 shillings net, postage 1 shilling.

RARE FISH TAKEN AT SAN PEDRO.

During the past summer a brief inquiry into the usage of common names ot the commercial fishes at San Pedro was started to aid in the proper interpretation of the statistical returns of the fishery. This entailed regular trips to the markets by the members of the laboratory staff and a close scrutiny of all doubtful species. In this way ninety-three separate species in the commercial catch have been recognized and their common names noted. A few of these being rare in this locality are worthy of mention.

Among surf-perches (Embiotocidae), few of which are distinguished by the dealers except as "white-, black-, and blue-perch," were several species of especial interest. *Phanerodon atripes*, which to our knowledge has never been recorded south of Monterey since Eigenmann's specimen from Cortez Bank, was represented in our collection by one specimen. *Rhacochilus toxotes*, said to be rare in this locality, was seen by us rather commonly. *Damalichthys argyrosomus*, though common northward, was found occasionally in June and September.

Of the forty species of rockfish or "rock cod" (*Sebastodes* sp.) taken on the California coast, twenty-eight have appeared in the San Pedro markets during June and July. Only two of these species occurring most commonly have well known common names, the bocaccio (*S. paucispinis*) and the chilipepper (*S. goodei*). Many fishermen distinguish between the different species, using names of their own invention, but there is little uniformity among them. Thus, *S. mineatus*, one of the most abundant species, is often called "red rock cod" and sometimes "salmon grouper," although the latter is also applied to *S. goodei*. *S. levis* is called "Harry Olesen" by some, and *S. chlorostictus* is the "chucklehead." The three small, dark-colored species, *S. atrovirens*, *S. serranoides*, and *S. rastrelliger* are frequently confused with the rock bass and included with them in the markets. All the other species are lumped together as "rock cod," by the fishermen, and this practice is extended by the marketmen to include all the rockfish.

The rarer species encountered during the summer are here listed. Two specimens of *Sebastodes cos* were taken at San Clemente I. in June, and several have since been seen in the markets. This species was reported by Eigenmann in 1892 as abundant at times at San Diego, but it has rarely been seen by naturalists since that time.

Two specimens of *Sebastodes gilli* also were taken in July. The occurrence of this species has not been recorded since the original record by Eigenmann in 1891, and it is known only from the types taken at Point Loma.

A specimen of *Sebastodes introniger*, another rare species, was taken at San Nicolas I. during June in eighty fathoms of water. It is one of the deeper water rockfishes and the few specimens known have been taken in Alaska in from 85 to 350 fathoms, on the coast of Washington, and in southern California waters in depths from 178 to 369 fathoms.

Sebastodes ovalis, another rockfish formerly supposed to be quite rare, has occurred in small numbers in the markets on several occasions during the summer. —E. H. and O. E. S.

REPORTS.

VIOLATIONS OF FISH AND GAME LAWS.

April 1, 1921, to June 30, 1921.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without license	6	$95 00
Ducks (wild)—closed season—possession or hunting	3	25 00
Deer meat—closed season—possession	13	400 00
Deer—closed season—killing	4	160 00
Birds (non-game)—possession	2	75 00
Doe—closed season—killing	2	125 00
Pigeons—closed season—killing or possession	3	50 00
Quail—closed season—possession or killing	3	10 00
Geese (wild)—closed season—possession	3	25 00
Bear—closed season—killing	1	----------
Beaver hide—possession	1	25 00
Doves—closed season—killing or possession	5	175 00
Brush rabbits—closed season—killing	2	75 00
Cottontail—closed season—possession or killing	2	60 00
Spike buck—killing	1	100 00
Cub bear—taking	1	10 00
Discharging oil in San Francisco Bay	1	200 00
Making false statement on application	1	25 00
Failure to produce license on demand	1	25 00
Total game violations	55	$1,660 00
Fish.		
Angling without license	23	$470 00
Striped bass undersized, offering for sale underweight, shipping undersized, possession or excess limit	22	580 00
Black bass—closed season—possession, undersized or spearing	11	175 00
Crabs—undersized, possession	5	100 00
Crab meat—detached from shell	1	100 00
Abalones—undersized, possession—closed season	38	1,535 00
Abalones—failure to bring to shore attached to shell	1	25 00
Clams—excess limit—undersized—possession	12	290 00
Trout—excess limit—selling—taking in closed season	8	240 00
Catfish—selling undersized—retaining undersized in live cars	3	60 00
Perch—closed season—possession	2	----------
Sturgeon—possession	1	20 00
Lobsters—undersized, possession—closed season	3	65 00
Halibut—undersized—selling	1	25 00
Fishing within 250 feet of fishway	7	175 00
Fishing for profit without license	9	100 00
Fishing for profit excess limit	1	25 00
Fish trap, using	1	----------
Trawl net, using in District 9	2	200 00
Dragging inside three-mile limit	1	100 00
Illegal net in restricted district	4	300 00
Saturday-Sunday fishing	2	40 00
Taking fish without hook or line	1	25 00
Total fish violations	159	$4,650 00
Grand total fish and game violations	208	$6,310 00

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF APRIL, MAY AND JUNE, 1921.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Tehama, Colusa, Glenn, Butte	Contra Costa, Alameda	San Francisco, Alameda	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican, brought into California
Albacore												2,177		667		2,844	
Anchovies								57,420		489,192		6,068		228,761		781,441	
Barracuda											13,815	2,051,474	14,603	650,292		2,733,184	35 355
Bluefish									494	10,678						11,172	
Boccaccio		125						11,942	11,904	193,168						217,139	
Bonito											45	6,323	27	6,718		13,113	555
Carp			67	2,617			9,070	5,904								17,688	
Catfish		3,353		3,754	699		10,005									17,811	
Chilipepper					18,018				883							18,901	
Cultus Cod	3,209	1,293						17,301	10,267	22,482						51,552	
Dolphin																	
Eels																	
Flounders	41		56	183			4,519	70,258	10,925	461	996	1,136				88,578	
Grayfish							507	1,500				2,450	250	183,110		187,847	
Greenfish																	
Hake								22,838	488							23,326	
Halibut	11,910	2,132						3,792	538	2,990	108,926	541,365	58,071	179,818		909,572	142 660
Hardhead				32												32	
Herring			4,925								269					5,194	
Kingfish								1,245	14 995	36,057	55	81,258	534	1,031		135,175	425
Mackerel									937	20,117	2,630	449,266	8,507	130,556		612,043	1,953
Marlin																	
Mullet												301		8,574		8,875	
Perch	1,738		8,495				311	8,876	2,024	9,521	18	25,395	679	337		57,394	
Pike				736	123	27	907									1,793	
Pompano									17	138	108	4,549	52	110		4,974	
Rock Bass												51,482	13,193	58,435		123,110	1,795
Rockfish	13,628	2,348	110					55,852	21,312	61,576	17,484	198,274	5,066	112,023		487,673	12,987
Sablefish								62,196	380,213	3,541						445,950	
Salmon	42,085	995,562	407	187,537	221 868	108,139	289,925	127,618	371.753	680.084						3,025,278	
Sandabs								197,814	13,000	2 124		2,389	13			215,340	
Sardines			138					750	100	1,013,484		6,031,195		155,030		7,200,697	
Sculpin												18,635		4,836		23,471	
Sea Bass—Black											378	9,336	553	11,733		22,000	1,707
Sea Bass—White									22	23	3,427	974,202	1,870	125,739		1,105,283	10,419
Sea Trout												29	833	700		1,562	
Shad				2,109	470		6,157	16,496								25,232	
Shad—Buck				37,153	23,331		152,306									212,790	
Shad—Roe				71,094	25,919		443,125									540,138	
Sheepshead											89	1,631	67	7,496		9,283	

Skates					43,146			8,765				260	358			52,529	
Skipjack																	
Smelt	19,998		3,005				5,156	38,479	11,856	8,689	27,806	28,731	174	3,007		146,901	240
Sole	76							761,762	111,028	22,275	8,251	16,926	596			920,914	
Splittail				46			140									186	
Striped Bass			1,332	30,028		48	76,179	48,931								156,548	
Stingaree														6,795		6,795	
Suckers																	
Surf Fish																	
Swordfish												332				332	
Tomcod								6,490								6,490	
Trout—Farm																	
Trout—Steelhead																	
Tuna												72,157		54,201		126,358	42,991
Tuna—Bluefin												87,128				87,128	59,835
Tuna—Yellowfin												4,205				4,205	5,558
Turbot			73													73	
Whitebait			708					308								1,016	
Whitefish											120	1,848		752		2,720	
Yellowtail												241,918	34	83,484		325,436	7,769
Miscellaneous		1,390					176	5,744	6,109	74,821	3,249	11,725	816			104,030	
Croakers												10,223				10,223	
Total fish	92,715	1,006,203	19,316	335,319	333,574	108,514	998,483	1,532,311	968,895	2,651,424	187,666	10,937,388	106,296	2,014,238		21,292,342	324,279
Crustaceans:																	
Crabs (doz.)	1,388	86	27					5,277	15	1						6 794	
Ecrevisse (doz.)																	
Shrimps								214,232		1,006		25				215,263	
Spiny Lobsters																	318,456
Mollusks:																	
Abalones	3,398		405							409,342	8,212					421,357	
Clams—Cockle	320	415	1,997									83				2,815	
Clams—Mixed	3,070		13,762								46					16,878	
Clams—Pismo											73,637					73,637	
Clams—Softshell	154	4,371	125					13,771								18,421	
Cuttlefish			23					1,899	1,785	9 632		19				13,358	
Limpets																	
Mussels										60						60	
Oysters—Eastern (No.)			621,010							985						621,995	
Oysters—Native			6 540													6,540	
Snails																	
Squid										116,398		26 759		86,482		229,639	
Miscellaneous:																	
Frogs (doz.)																	
Terrapins (doz.)		5														5	
Turtles																	1,690
Scallops											735					735	

All amounts shown in pounds unless otherwise specified.

SEIZURES.

Fish and Game and Illegally Used Fishing Apparatus.

Game.

Ducks	6	
Deer meat	158	lbs.
Blue cranes 11	90	lbs.
Rabbits	13	
Pigeons	7	
Geese (wild)	5	
Beaver hides	2	
Doves	6	
Quail	3	

Fish.

Striped bass	1420	lbs.
Striped bass	12	
Black bass	4	lbs.
Black bass	4	
Clams (Pismo)	1871	
Clams (cockle)	28¼	lbs.
Lobsters	19	
Lobsters	91½	lbs.
Sole	18	lbs.
Crabs	295	
Crab meat	8	lbs.
Abalones	333	
Abalones (black)	15	
Trout	413	
Trout	2½	lbs.
Perch	4	lbs.
Catfish	35	lbs.
Barracuda	2720	lbs.
Halibut	365	lbs.
Sturgeon	18	lbs.
Shad	1	
Carp	1	
Illegal nets	3	

FISH AND GAME COMMISSION.

Statement of Expenditures for the Period from July 1, 1920, to June 30, 1921.

Administration:		
Commissioners	$1,115 49	
Executive offices	26,443 43	
Printing	8,073 62	
Research and publicity	6,073 62	
Accident and death claims	1,754 69	
		$43,460 85
Commercial fish culture and conservation:		
Superintendence	$15,731 18	
Inspection and patrol	31,488 15	
Research	31,257 88	
Statistics	10,269 64	
Market fishermen's license commissions	535 50	
Propagation and distribution of salmon	26,164 92	
		115,447 27
Sporting fish culture and conservation:		
Superintendence	$15,058 43	
Printing	299 54	
Prosecutions and allowances	496 15	
Angling license commissions	16,879 50	
Fish exhibits	4,323 19	
General patrol (pro rata share)—		
San Francisco District (40 per cent)	39,296 85	
Los Angeles District (40 per cent)	16,981 60	
Sacramento District (40 per cent)	28,774 32	
Propagation and distribution of trout	150,405 57	
		272,515 15
Game conservation:		
Printing	$461 13	
Prosecutions and allowances	1,057 45	
Hunting license commissions	24,605 60	
Mountain lion hunting (and bounties)	8,489 98	
General patrol (pro rata share)—		
San Francisco District (60 per cent)	58,713 22	
Los Angeles District (60 per cent)	25,370 37	
Sacramento District (60 per cent)	43,158 88	
		161,856 63
Tahoe camping ground		684 04
Total		$593,963 94

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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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CALIFORNIA'S GAME REFUGES.

By Harold C. Bryant.

Each state, as it has seen its game decrease in spite of protective legislation, has sought for some additional means of conservation which would improve conditions. A fundamental law of business is to the effect that although we spend, we must not waste our capital. This is as true of wild life as it is of money. Present conditions show that we have lavishly spent not only the income, represented in annual increase of our game, but have also drawn largely upon our capital, represented in breeding stock. To invest our remaining capital in such a manner as to provide a sure income, has become the most important problem in wild life conservation. Although we may have heard this simile until it seems almost trite, yet it accurately describes present conditions.

In recent years it has become apparent that the very best means of safeguarding our capital of breeding stock is not to be found in season and bag limit laws, but in the establishment of game sanctuaries where wild life is allowed to breed unmolested, and where in time it increases, spreading out to neighboring territory and furnishing food and sport for all those who care to seek it.

Two outstanding factors involving the decrease of game have combined to make the establishment of refuges urgent. In the first place, settlement has reclaimed many of the natural breeding grounds of game with a consequent destruction of food supply. Secondly, in many places in California the country is becoming thickly populated, with a consequent concentration of hunting in nearby localities. The use of the mountains by city people is being continually encouraged and is growing. These factors make it increasingly difficult for game to maintain itself.

The game refuge furnishes an area where game may find natural and safe breeding and feeding grounds in order to insure a sufficient number being left to prevent extermination and, if possible, to keep neighboring territory sufficiently stocked to allow of good hunting.

With the rapid settlement of the country it will soon be impossible to find areas where natural conditions exist. Sportsmen of the future will be forced to do their hunting on artificially planted private grounds, or kill game reared on game farms, unless certain areas are maintained in their natural state. Herein we find an important reason for the establishment of national parks and state game refuges. Not only will the sportsmen benefit thereby, but also the scientists interested in natural history, for the parks and refuges will soon be the only areas unspoiled for scientific study.

That California has done something more than talk about the value of game refuges, is evidenced by the fact that twenty-eight refuges, comprising over two million acres of land, have been set aside by the state. The total area on which animal life is given absolute protection comprises nearly three million acres, for the state is fortunate in having within its borders three federal bird reservations, three national parks and three national monuments, in all of which wild life receives complete protection.

HISTORY.

Even before there were bag limits or seasons on game, the state legislature was convinced of the necessity of giving waterfowl careful protection on a lake in the city of Oakland. In 1869 an act restricting fishing and hunting in and about Lake Merritt, Alameda County, became a law. The thousands of ducks which gather on this lake every winter attest the efficacy of the refuge. Eleven species of ducks regularly resort to the lake in winter, with the pintail, baldpate, canvasback, and ruddy predominating. In fact, the waterfowl have become such a great attraction to both citizens and tourists that the city finds it worth while to furnish grain to feed the birds.

State game preserves.

Sentiment favoring this means of conservation became crystalized in 1907, when an act providing for the establishment of state game preserves became law. The law provides that

> "Any person, firm or corporation, owning and in possession of patented lands in the State of California, embracing an area of not less than one hundred and sixty acres, may transfer, by an instrument in writing, duly acknowledged before an officer authorized under the laws of this state to take acknowledgments, to the State of California, the right to preserve and protect all wild game on the land described therein for a period of not less than five years."

In 1913 a change was made in this law, which made it more effective, the time limit being extended to cover a period of ten years instead of five.

Advantage has been taken of this law in only a few instances. At present there are but three state game preserves. One is situated on the land of Mr. Bryan in Monterey and San Benito counties, and the other two are located near each other in Santa Barbara County. Too often applicants attempting to make use of the law show a desire to preserve areas for selfish gain, and not for the benefit of the game itself.

Big game refuges.

Unfortunately no additional refuges were created until 1909, when the Pinnacles National Monument, situated in San Benito and Monterey counties, was made a game refuge.

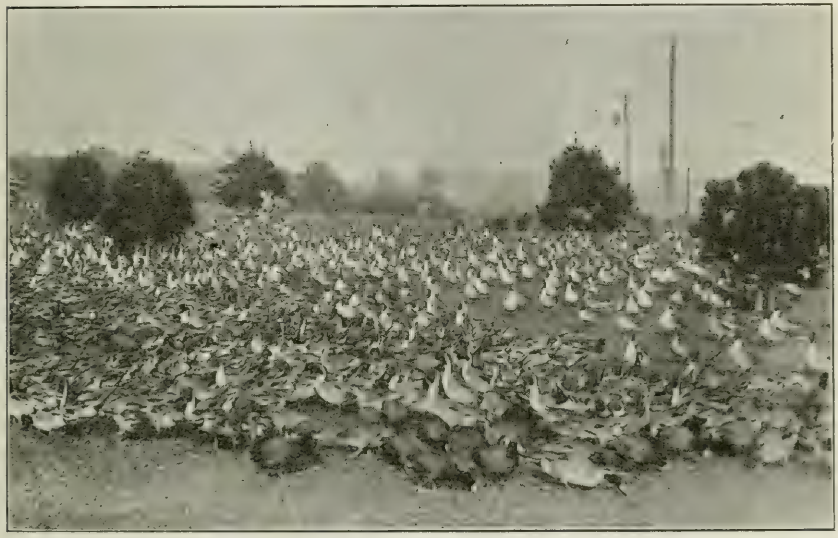


FIG. 1. A few of the wild ducks on Lake Merritt, a game refuge created in 1869. The city of Oakland feeds these winter visitors to add attractiveness to the city park. Photograph by H. C. Bryant, January 6, 1919.

A large area within the Cleveland National Forest in southern California was made a refuge in 1913. In 1915 there was added an area in the California Redwood Park, in Santa Cruz County, commonly known as the Big Basin, a portion of the Trinity National Forest, in Trinity County, and a large part of the Angeles National Forest, in Los Angeles and San Bernardino counties, the Trinity refuge comprising 64,000 acres and the Angeles 600,740 acres. Both refuges have been increased in size since their creation. In the same year the areas covered by the Trinity and Los Angeles forests were included in the Districting Act, so that legally these refuges are known as fish and game districts. A special law prohibits hunting within the fish and game districts specified as game refuges.

In 1917 the legislature set aside sixteen large areas within the national forests as game refuges. These refuges, scattered from Siskiyou to San Diego County, are as follows:

1A—Siskiyou
2A—Mendocino and Lake
1B—Modoc
1C—Modoc
3C—Santa Barbara
3D—Ventura
4D—Riverside
1E—Shasta
4E—San Diego
1F—Lassen
1G—Tehama
1H—Plumas
1I—El Dorado
1J—Amador
1K—Fresno
1L—Tulare and Kern
Mount Tamalpais—Marin

The selection of the refuges was made possible through the cooperation of the United States Forest Service.

The situations were chosen with reference to the kinds of game to be found; whether both summer and winter range was furnished; the food supply, and the ease of administration. Particular attention was given the boundaries, the attempt being made to use natural boundaries such as ridges and creeks rather than artificial section and township lines recognized with difficulty by the hunter. The legislators were unanimous in carrying out the recommendations.

Three additional areas were created by the 1919 legislature, and one by the 1921 legislature.

Up to the present time, therefore, the state has set aside twenty-eight game refuges and three game preserves, comprising nearly two million acres. These are so situated that they form a chain of refuges, properly spaced, extending from the Oregon line to the Mexican border.

It has been surprising to see how quickly sentiment has come to favor the refuges established. One would have thought that a great deal of complaint would have emanated from hunters when such large areas were selected in some of the best hunting grounds of the state in 1917. The fact is that many who did not favor the refuges when first created now are enthusiastic supporters of the policy. The value of the refuge has been demonstrated to the most sceptical.

FEDERAL BIRD RESERVATIONS.

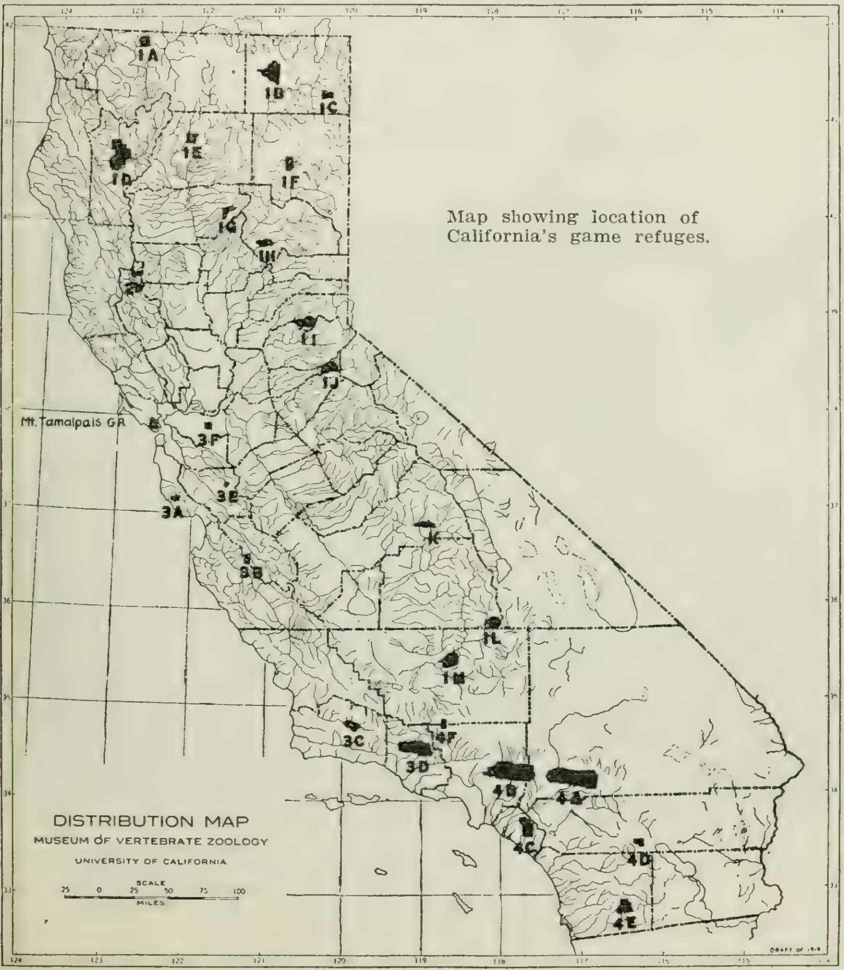
Beginning with the presidency of Theodore Roosevelt, considerable interest was taken in the setting aside of notable breeding areas of waterfowl. The Klamath Lake Reservation was created in 1908; East Park and the Farallon Island Reservation in 1911, and the Goat Island Reservation in 1916.

Unfortunately, conditions in the best of these reservations, the Klamath Lake Reservation, are far from satisfactory. As a result of continued endeavor on the part of land promoters, Lower Klamath Lake is being drained, leaving large areas of alkali and mud flats which neither benefit the settlers adjoining the lake nor furnish additional land suitable for agriculture. Drainage has allowed the starting of large tule fires which, in addition to the lack of water, has rendered large areas unfit for occupation by birds. Unless a change in policy is made in the near future, this valuable reservation for wildfowl is seriously jeopardized. The Farallon Island Reservation forms a splendid sanctuary for murres and other sea birds.

The East Park Reservation proved to be of little consequence in that there was not a suitable food supply attractive to wild fowl on the East Park Reservoir. Investigation having shown that this reservation, and also the San Francisco Bay Reservation on Goat Island, which was mainly useful for the preservation of pheasants planted on the island, were comparatively little visited by wild fowl, an elimination of these reservations was recommended and the President eliminated them by an executive order dated May 20, 1921.

NATIONAL PARKS AND MONUMENTS.

California is fortunate in having within its borders three national parks and three national monuments, which add nearly a million acres to the state's reservations. As all wild life within these areas is absolutely protected, the national parks and monuments constitute some of our best refuges. The large size of the parks in particular, and their advantageous situation, make them especially adapted for the conservation of big game. A visit to any of these parks will demonstrate the usefulness of the policy of protecting all wild life found within their borders.


Map showing location of California's game refuges.

CALIFORNIA'S GAME SANCTUARIES.

CALIFORNIA IS ASSURING A PERPETUAL SUPPLY OF GAME BY SETTING ASIDE AREAS WHERE NO HUNTING IS ALLOWED AND WHERE GAME IS ALLOWED TO BREED UNMOLESTED. THE STATE IS RESPONSIBLE FOR THE CREATION OF MOST OF THEM, THE FEDERAL GOVERNMENT FOR OTHERS. CERTAIN AREAS KNOWN AS GAME REFUGES HAVE BEEN SET ASIDE BY LEGISLATIVE ENACTMENT. OTHERS KNOWN AS STATE GAME PRESERVES HAVE BEEN CREATED BY THE FISH AND GAME COMMISSION AFTER THE OWNER OF THE PROPERTY HAS CEDED ALL HUNTING PRIVILEGES TO THE STATE FOR A PERIOD OF NOT LESS THAN TEN YEARS. THE FEDERAL GOVERNMENT HAS SET ASIDE THREE BIRD RESERVATIONS AND PROTECTS ALL OF THE WILD LIFE WITHIN THE NATIONAL PARKS AND NATIONAL MONUMENTS. AS A CONSEQUENCE GAME IS NOW ABSOLUTELY PROTECTED ON NEARLY 3,000,000 ACRES WITHIN THE STATE OF CALIFORNIA, AN AREA ROUGHLY EQUIVALENT TO THREE PER CENT OF THE TOTAL AREA OF THE STATE.

GAME REFUGES.

Name	County	Area, acres	Established
1A	Siskiyou	22,540	1917
1B	Modoc	83,060	1917
1C	Modoc	21,760	1917
1D	Trinity	82,560	1915
1E	Shasta	37,760	1917
1F	Lassen	46,720	1917
1G	Tehama	33,920	1917
1H	Plumas	37,760	1917
1I	El Dorado, Calaveras	67,840	1917
1J	Amador	58,320	1917
1K	Fresno	34,240	1917
1L	Tulare and Kern	35,520	1917
1M	Kern	81,920	1919
2A	Mendocino, Lake and Butte	35,200	1917
3A	Santa Cruz	4,480	1915
3B	San Benito and Monterey	14,080	1909
3C	Santa Barbara	41,600	1917
3D	Ventura	125,760	1917
3E	Santa Clara	3,600	1919
3F	Contra Costa	10,240	1921
4A	Los Angeles	293,120	1915
4B	Los Angeles	325,120	1915
4C	Orange	99,840	1913
4D	Riverside	69,120	1917
4E	San Diego	51,840	1917
4F	Los Angeles and Kern	46,080	1919
Mount Tamalpais	Marin	28,000	1917
Lake Merritt	Alameda County (Oakland)	----------	1869
		1,792,000	--------

STATE GAME PRESERVES.

No. 5	Monterey and San Benito	8,570	1916
No. 6	Santa Barbara	42,000	1918
No. 7	Santa Barbara		
		50,570	--------

FEDERAL BIRD RESERVATIONS.

Klamath Lake	Siskiyou	*22,400	1908
Clear Lake	Modoc	*1,600	1911
Farallon Islands	Pacific Ocean, near San Francisco	----------	1909
		24,000	--------

*Approximate.

NATIONAL PARKS AND MONUMENTS.

Parks—			
Yosemite	Tuolumne and Mariposa	719,622	1890
Sequoia	Tulare	161,597	1890
General Grant	Fresno and Tulare	2,536	1890
Monuments—			
Lassen Volcanic	Shasta, Lassen, Plumas and Tehama	79,561	1916
Muir Woods	Marin	295	1908
*Pinnacles	San Benito	2,080	1908
		967,691	--------
		2,834,261	--------

*Included in State Game Refuge No. 3B.

←——**BOUNDARY**——→
STATE GAME REFUGE
Hunting Prohibited

FIG. 2. Type of notice, printed on tin, used to mark the boundaries of game refuges.

ADMINISTRATION.

Care is being taken to administer the game refuges in such a way as to make them most useful. Boundary notices often have been posted as well as cloth signs, warning the public that they are within a refuge.

WARNING

THIS IS FISH AND GAME DISTRICT ONE D, A GAME REFUGE
Created by Act of Legislature in 1915

It is unlawful to hunt, pursue, take, catch, kill, destroy or have in possession any wild animal or wild bird, except waterfowl, within the boundaries of this REFUGE.

PENALTY for violation: A FINE of not less than $100, or IMPRISONMENT of not less than 50 DAYS.

NOTE.—Predatory birds and animals may be killed and had in possession within this REFUGE under authority of permit issued by the Fish and Game Commission. Apply in writing for permit to nearest office of Commission.

This warning notice posted at direction of
California Fish & Game Commission
Offices: San Francisco, Sacramento, Los Angeles

FIG. 3. Type of warning notice used within a game refuge.

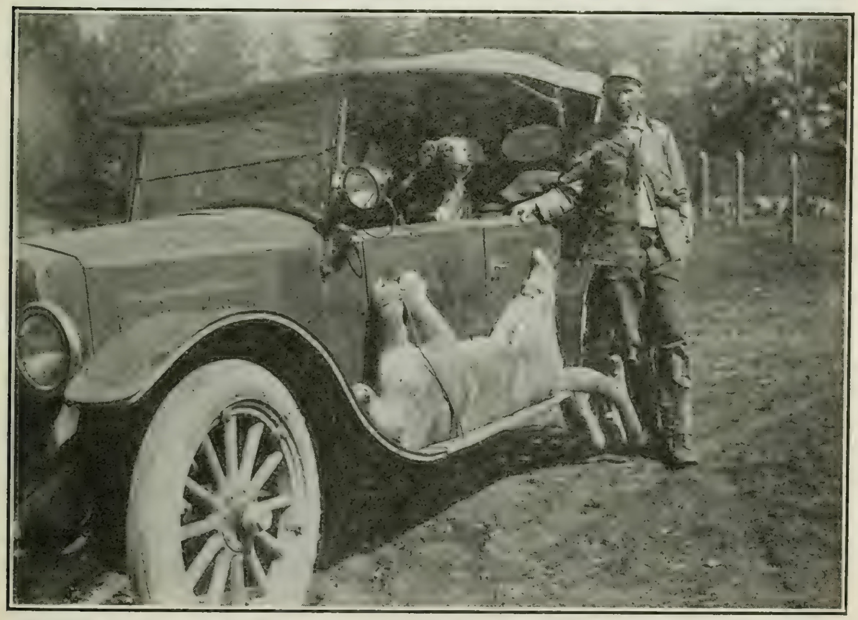


FIG. 4. Jay Bruce, state mountain lion hunter, with lion killed on the North Fork of the Stanislaus River, on March 27, 1921. His famous lion dog, Eli, occupies the front seat. A large proportion of the lions killed each year by Mr. Bruce are taken within game refuges. Photograph by W. J. Rodgers.

In several cases wardens have been located near refuges in order that they might be well patrolled and in other instances part-time men have been stationed within refuges during the open season to prevent poaching. Augmented patrol in the refuges is planned.

The control of predatory animals within a refuge is largely accomplished by issuing special permits to hunters and trappers making application. In addition, a state mountain lion hunter is retained whose duty it is to go from one refuge to another with his well trained dogs and reduce the numbers of wildcats and mountain lions. (See Fig. 4.) In 1920 Mr. Bruce secured thirty lions, a large percentage of which were killed within the boundaries of refuges. Five refuges and two national parks have thus far received a visit from Mr. Bruce and his lion dogs.

The greatest need now is the careful patrol of the present refuges and an effort to gain maximum efficiency; also the setting aside of refuges for the small herds of elk and antelope still found in the state. The herd of elk in Kern County will continue to be a problem because of their depredations until given a fenced refuge. The area to the south of Lower Klamath Lake, where the largest band of prong-horned antelope is found, should constitute a game refuge.

Another important consideration is whether or not increased opportunity should be afforded the recreationist within game refuges. At first thought it would appear that the game would benefit most by the lack of intrusion on the part of the vacationist, but there is another side. The efficiency of the game refuge is largely dependent upon the

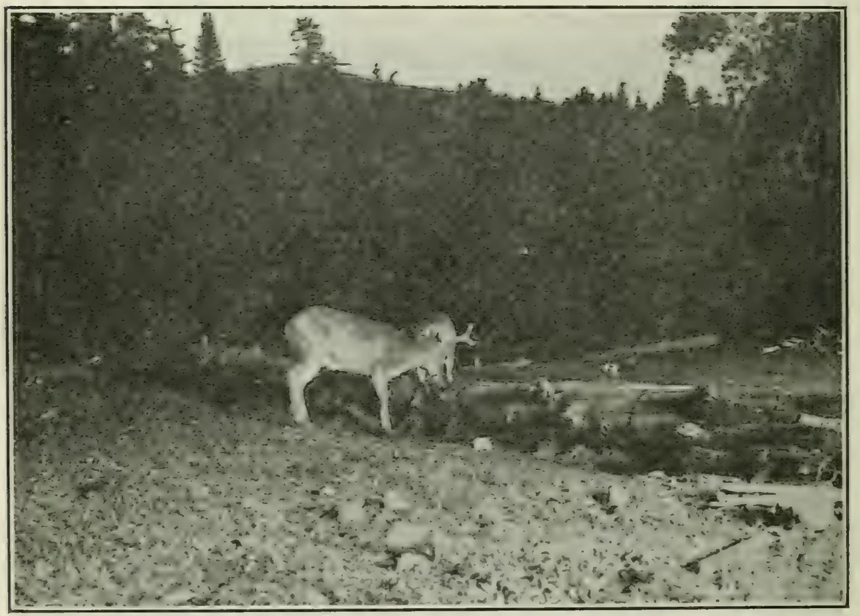


FIG. 5. Flashlight photograph of deer at salt log in Lassen National Forest. Salt for deer is provided in some of the game refuges. Photograph by courtesy of Forest Service.

public sentiment of neighboring communities, and this is dependent in turn upon the knowledge and interest of the individuals. Public interest is a necessity and for this reason the legitimate use of the refuge for recreation purposes will in the end benefit game conservation.

MAPS.

In order to acquaint the public with the state's refuges, their extent and boundaries, short descriptions accompanied by a series of maps prepared by Mr. J. S. Hunter, and which are published for the first time, follow. By use of these maps hunters will be able to plan their hunting trips so as to avoid trespassing within a refuge, and conservationists will be able to visualize the extent and topography of the various restricted areas.

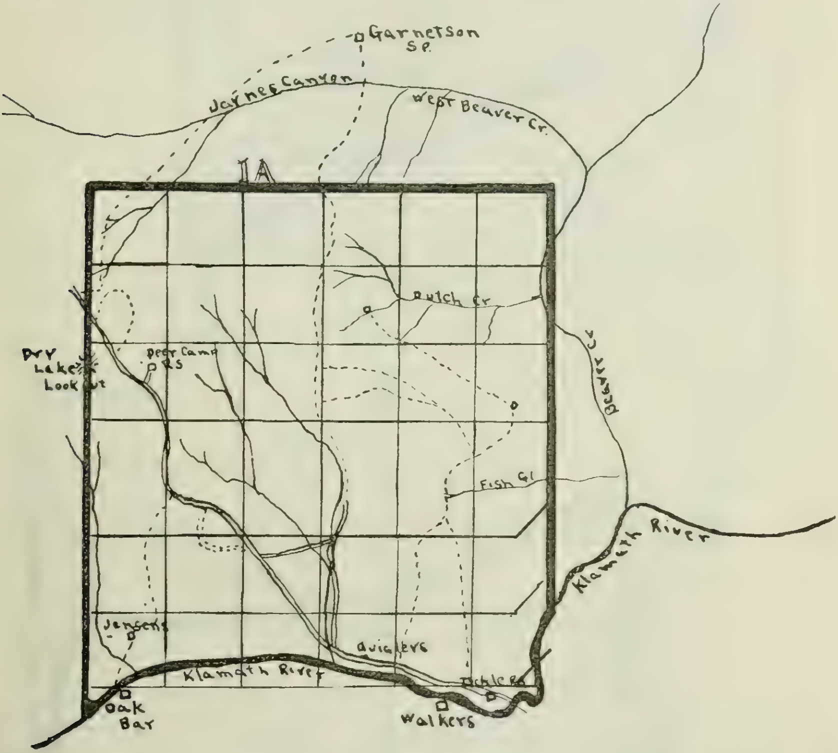


FIG. 6. Game Refuge 1A, situated in Siskiyou County, contains a large number of deer, furnishing summer range in the high mountains, and winter range in the low foothill section near the Klamath River. Nearly every type of forest and brush is represented. A fair salt lick is located near the center of the area. In addition to deer, there is an abundance of grouse, and both valley and mountain quail. Doves breed to a certain extent in the lower portion of the refuge. Located in the very heart of the county that is heavily hunted in the hunting season, the refuge furnishes a much needed protection for a large number of deer.

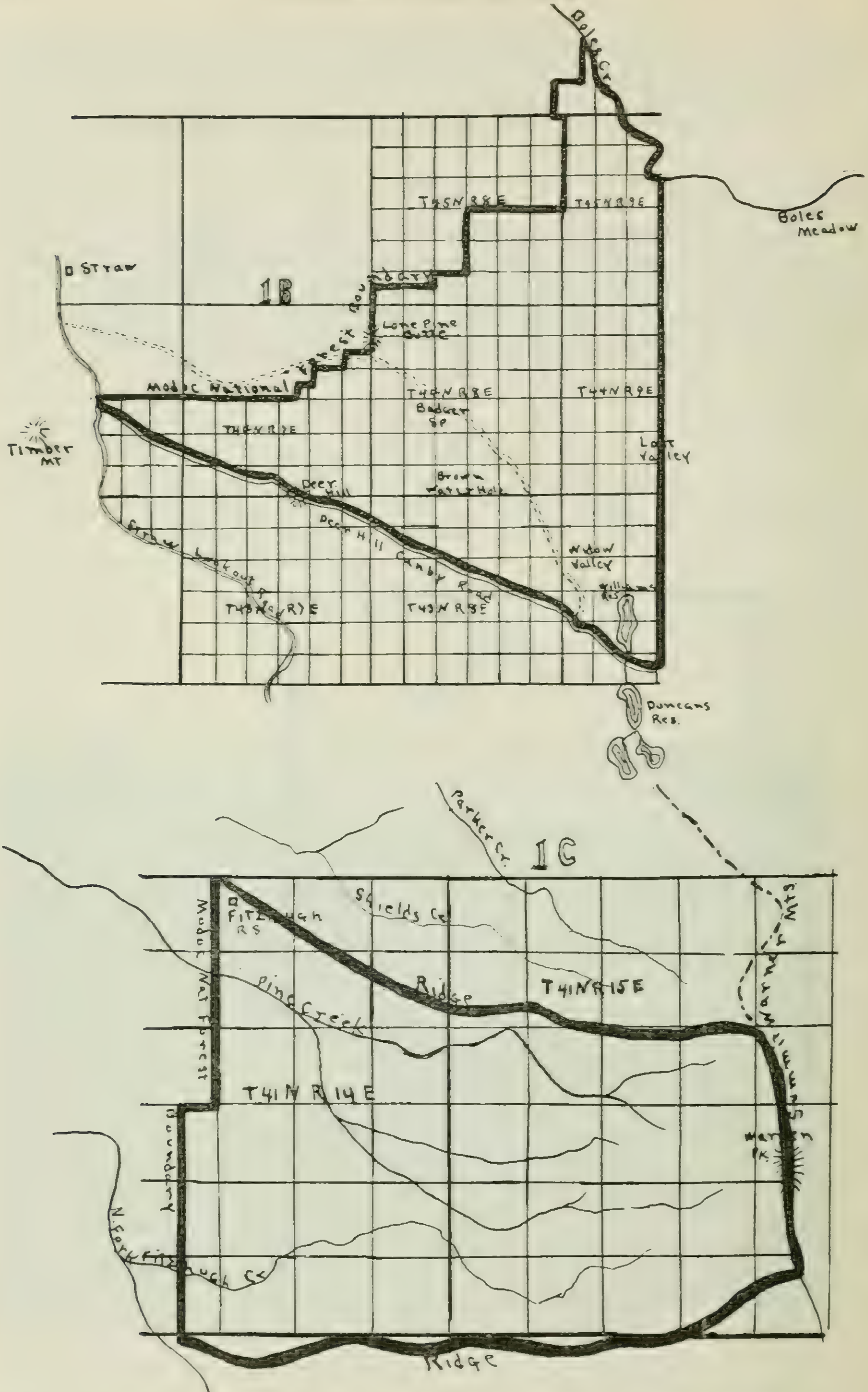


FIG. 7. Refuge No. 1B and 1C were set aside primarily to protect the mule deer. The cover is mostly a pure stand of yellow pine with some open flats of juniper and the low regions are covered with brush. Mowitz Butte, situated in 1B, is much frequented by mule deer, affording both a breeding place and wintering area. District 1C, comprising the headwaters of Pine Creek, in addition to furnishing protection to the mule deer, affords protection to grouse and quail. No better location in the Warner Mountains could have been selected than this area.

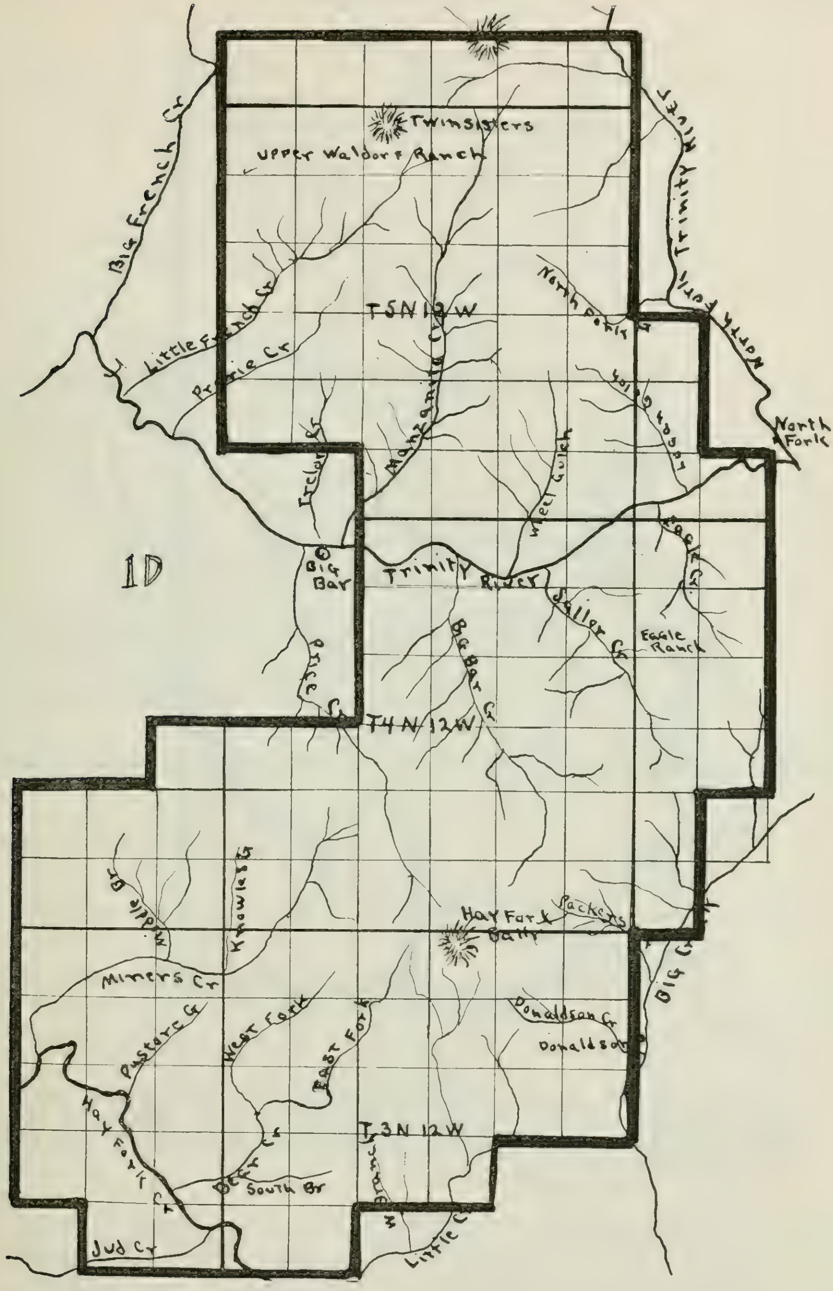


FIG. 8. Fish and Game District 1D, in Trinity County, has proved to be one of the best of the big game refuges. Perhaps its efficiency is simply more apparent because of the length of time since its establishment in 1915. Every resident of the region maintains that deer have greatly increased within the refuge. Certainly ideal conditions exist, there being wide range in elevation and many south exposures, furnishing abundant winter and summer range, so that game need not leave the refuge at any time. There are few places in the state where so many deer can be seen at close range. One adverse factor is becoming more and more important. Considerable grazing is allowed within the refuge and much food that would otherwise be available for deer is eaten by cattle, thus minimizing the population of deer which the area should support. Local sentiment in regard to this refuge has grown remarkably since 1915, changing from general disapproval of the restriction to a most favorable and enthusiastic attitude of cooperation.

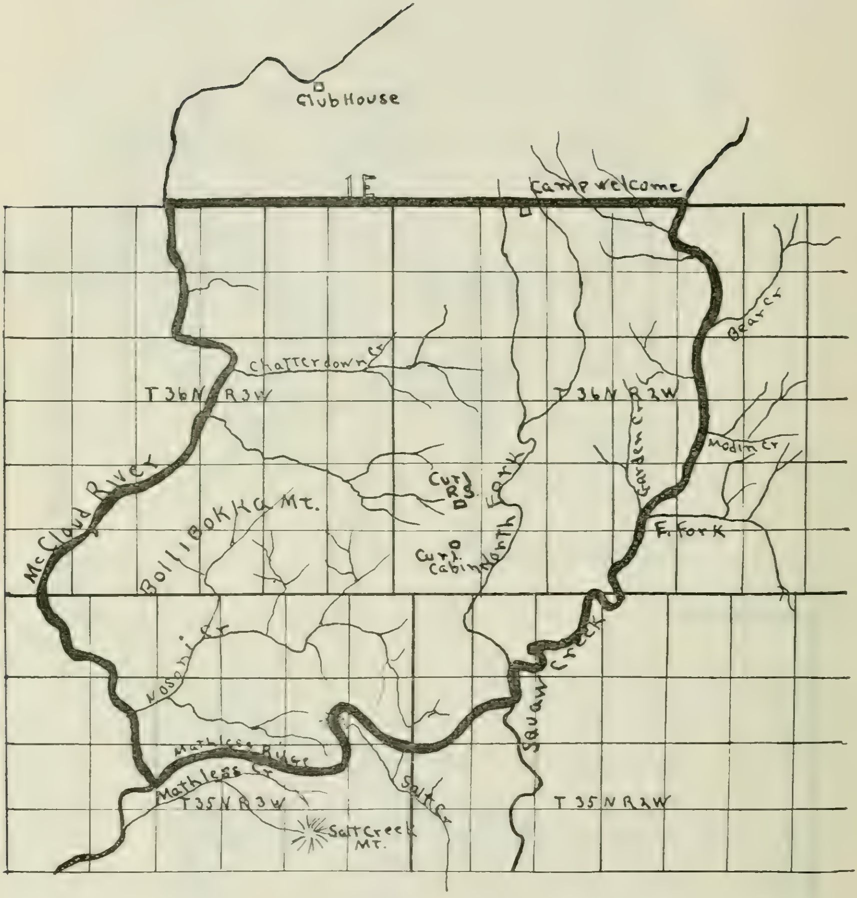


Fig. 9. Fish and Game District 1E, situated between Squaw Creek and the McCloud River in Shasta County, lies in the heart of some of the best hunting grounds in northern California. Year-round range is furnished big game, and both quail and grouse are abundant. A few bear are also found. Several natural salt licks make the area attractive to deer.

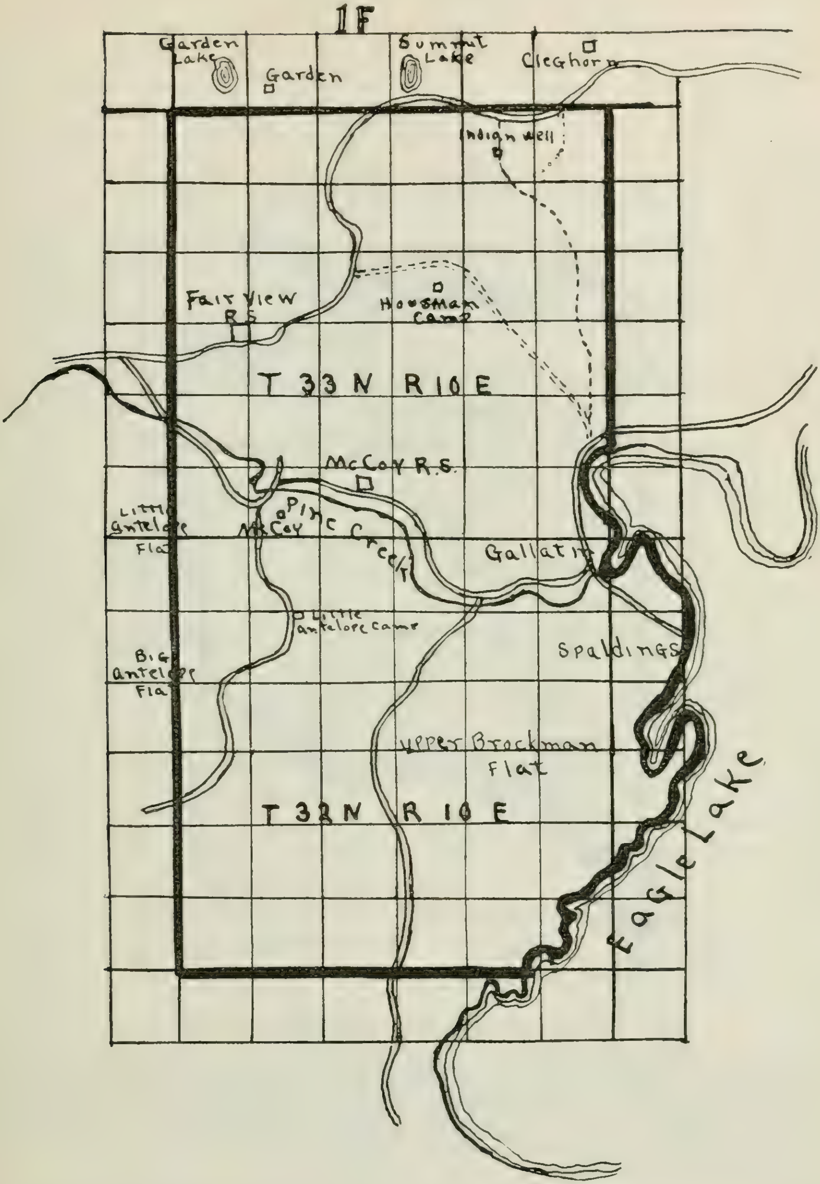


FIG. 10. Fish and Game District 1F, situated in Lassen County, embraces an area ranging from 4800 feet along the eastern edge to 6500 feet on the higher points. There are numerous meadows and also extensive areas covered with brush and with forest. When the refuge was formed it was estimated that 600 mule deer winter within the area. The outstanding feature of this refuge is that a few antelope remain within its borders. Although wholly protected by law, any advantage that can be given to this species should be provided, for few individuals are left of the numerous herds once found within the state. The fact that a few of these animals are within a game refuge should help prevent poaching which goes on in outlying districts. In that this refuge lies for the most part at such high altitude, it does not offer so much good winter range as do many other refuges.

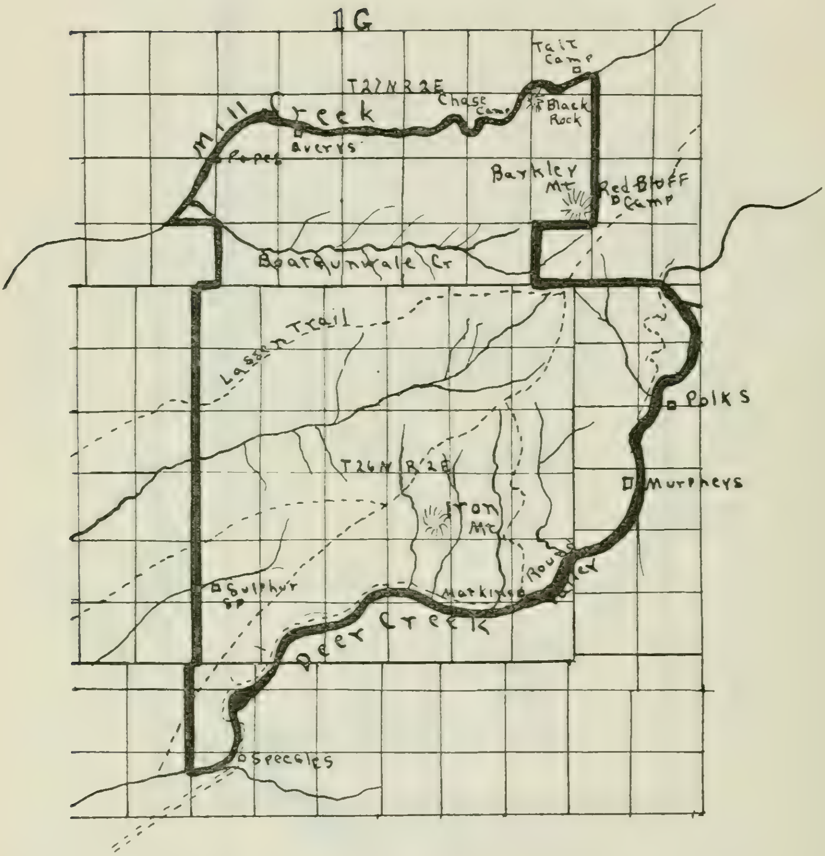


FIG. 11. Fish and Game District 1G, embracing a rough area between Mill Creek and Deer Creek in Tehama County, furnishes both summer and winter range for black tail deer, bears, and such upland game birds as grouse, mountain quail and valley quail. Deer concentrate in the western portion of the area in winter and spread out over the eastern part in summer. The forests covering the larger part of the refuge are white oak, digger pine, and brush on the winter ranges, and yellow pine, sugar pine, fir and cedar on the summer ranges. The winter range has excellent forage and is rarely completely snowed in.

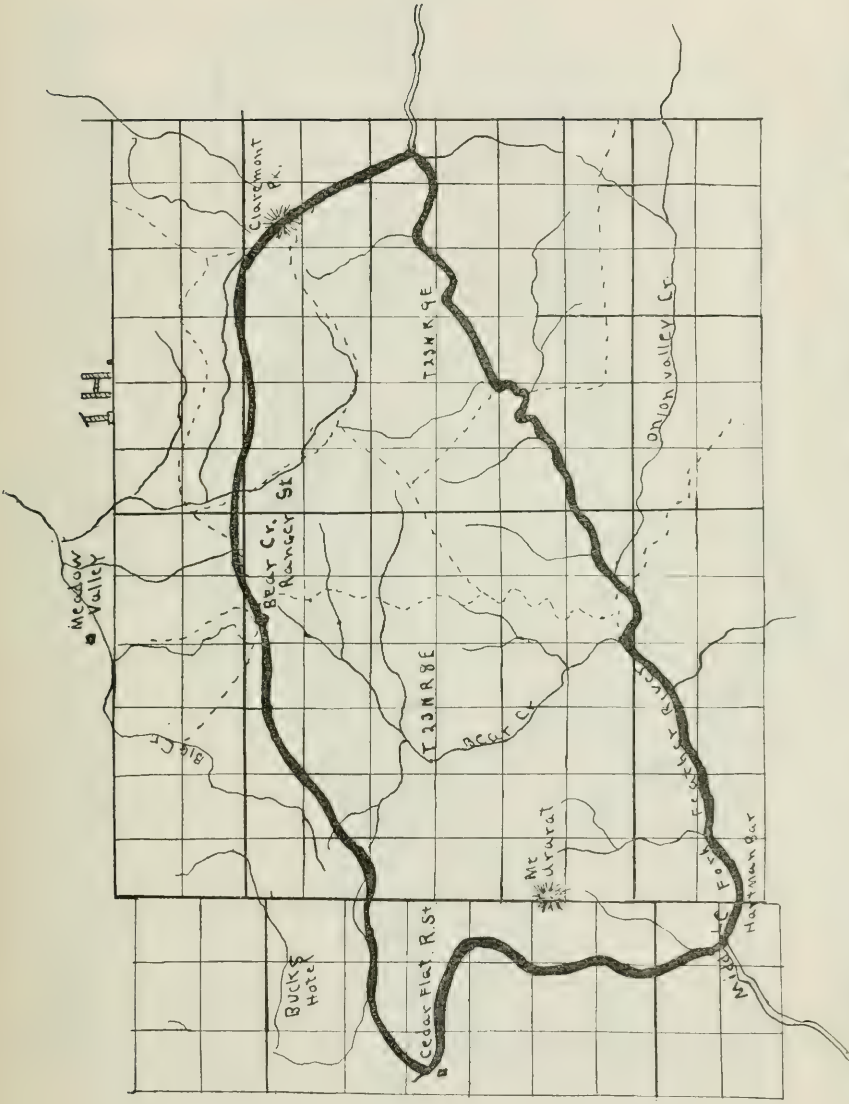


FIG. 12. Fish and Game District IH comprises an area on Mill Creek in Plumas County, ranging in altitude from 1600 feet on the west, to 7831 feet on Butte Mountain to the east, and offering both winter and summer range for big game. The western portion of the area forms a great winter resort for deer, both grass and browse being abundant; the eastern part furnishes a splendid summer range and deer are found in large numbers, as are mountain quail, valley quail and grouse.

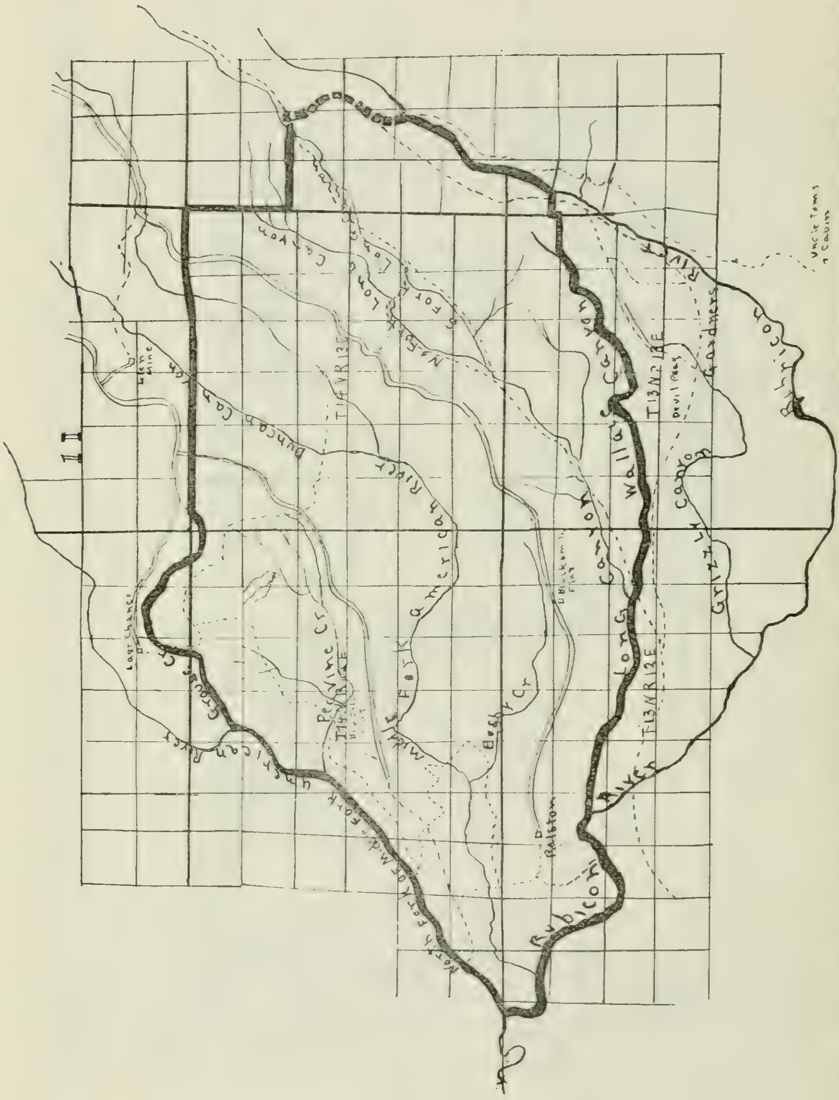


FIG. 13. Fish and Game District 11 comprises several long narrow ridges between the Middle Fork of the American River and its tributary, the Rubicon River. This refuge is well situated and has splendid natural boundaries. Brush covers the lower hills, and the flats above are covered with yellow pine. Excellent summer and winter range is furnished for deer; bear are also to be found. In fact, this refuge, situated in Placer County, is probably one of the best in the state, so far as deer are concerned.

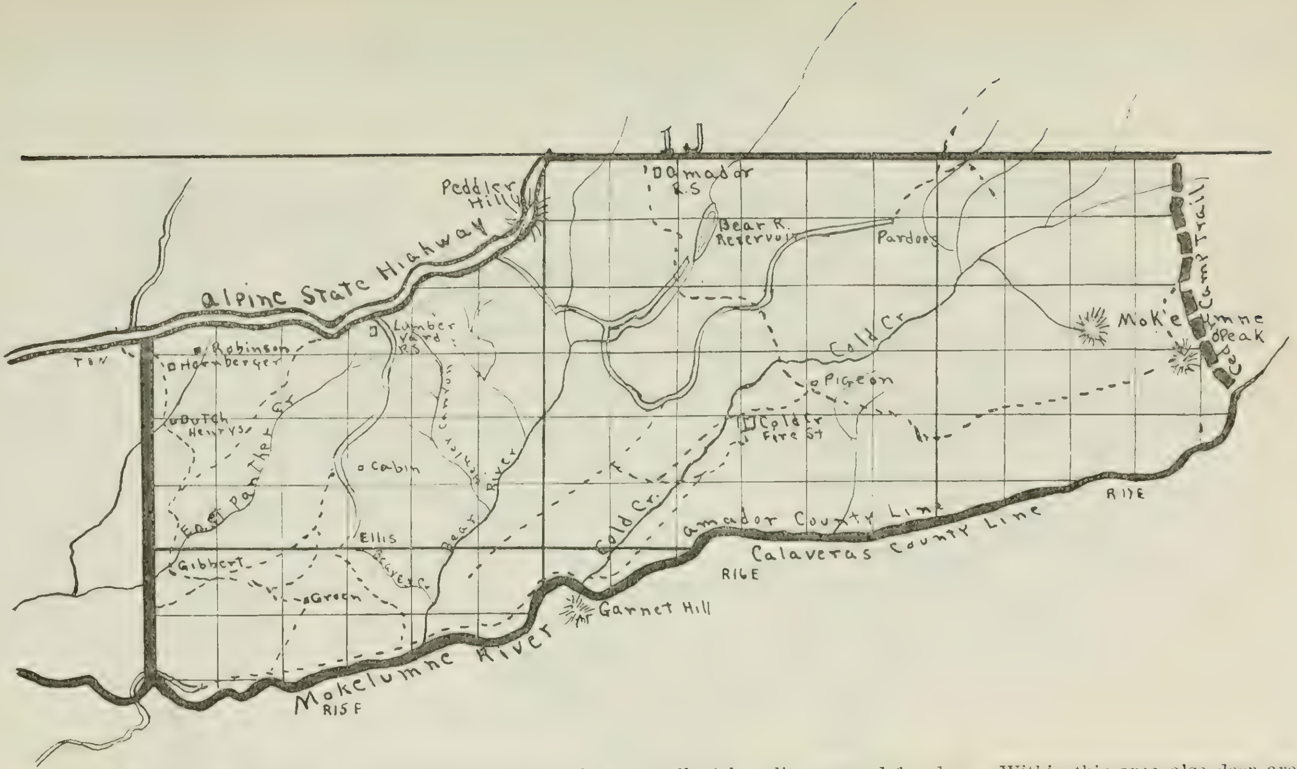


Fig. 14. Fish and Game District 1J, in Amador County, is an excellent breeding ground for deer. Within this area also deer are afforded numerous protected grounds where they may congregate during heavy snowfall. Bear are to be found in the district, as well as much small game.

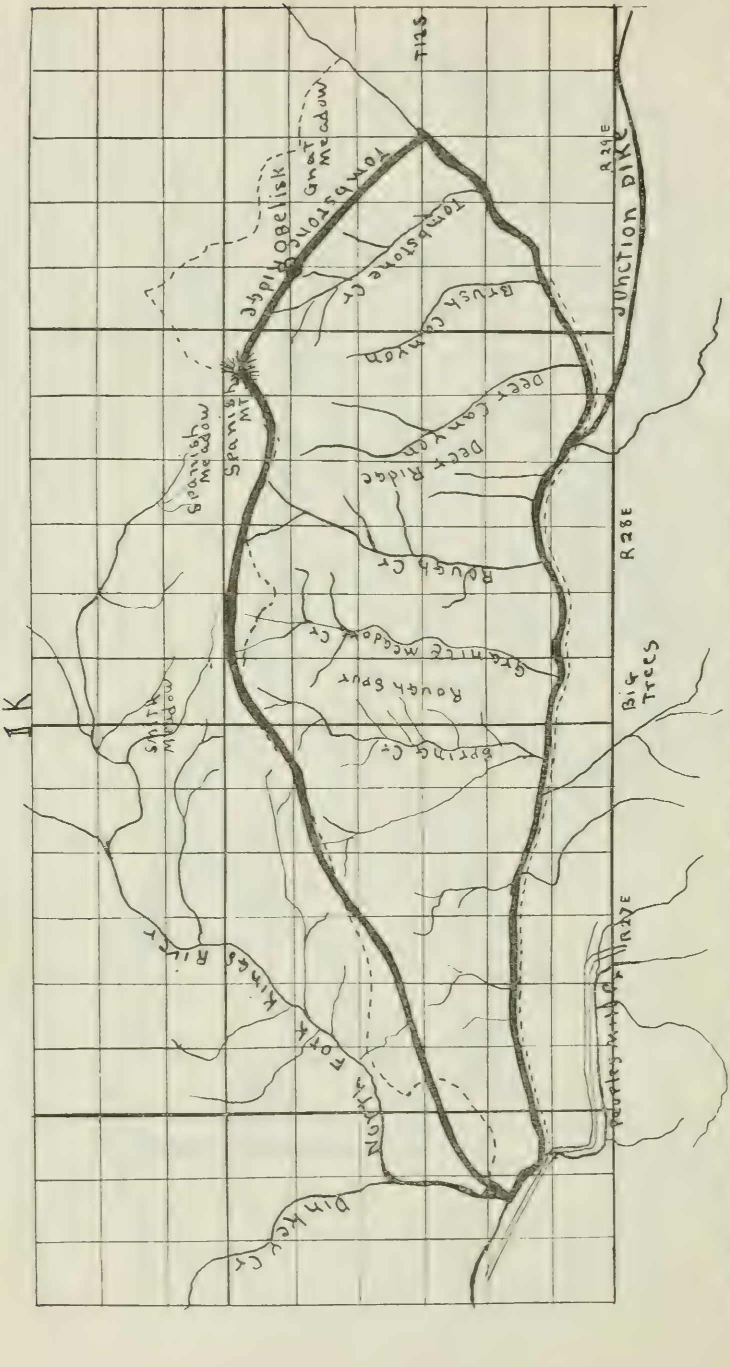


FIG. 15. Fish and Game District 1K comprises a number of ridges and canyons near the headwaters of the Kings River, in Fresno County. Forage for the large stock of big game is available both summer and winter, and the refuge should supply good hunting in surrounding territory for many years to come.

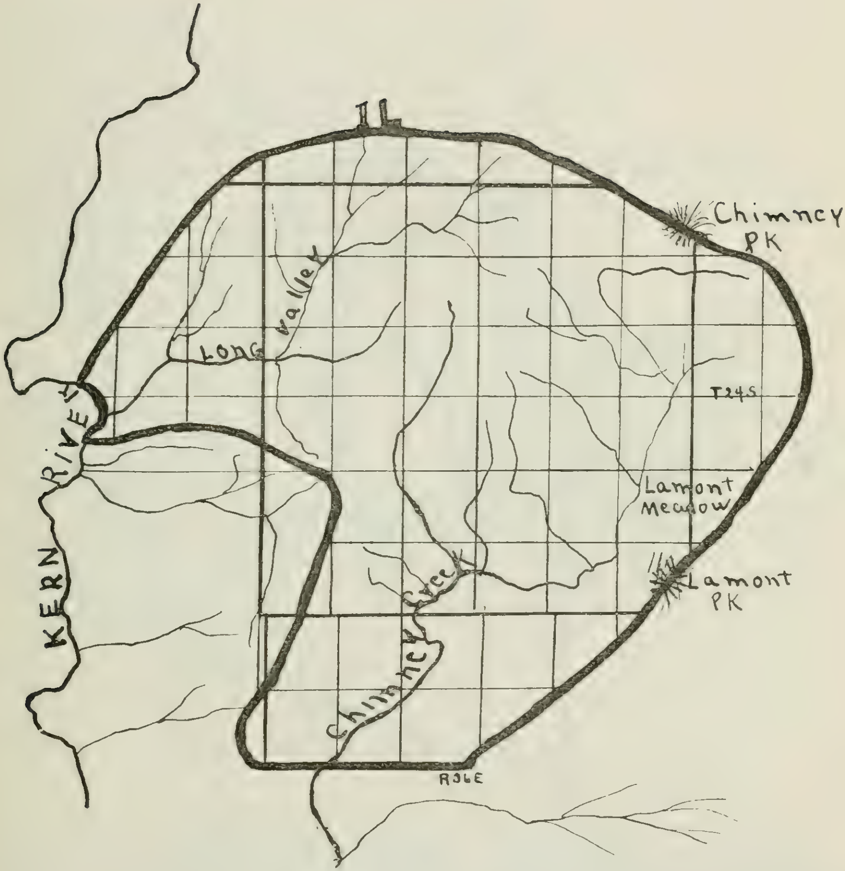


FIG. 16. Fish and Game District 1L comprises part of the drainage area of Chimney Creek, a tributary of the Kern River, in Tulare and Kern counties. Abundant food for big game is to be found. In that this district is located away from the main traveled roads, its usefulness as a refuge will increase as the country is opened up for hunters and recreationists.

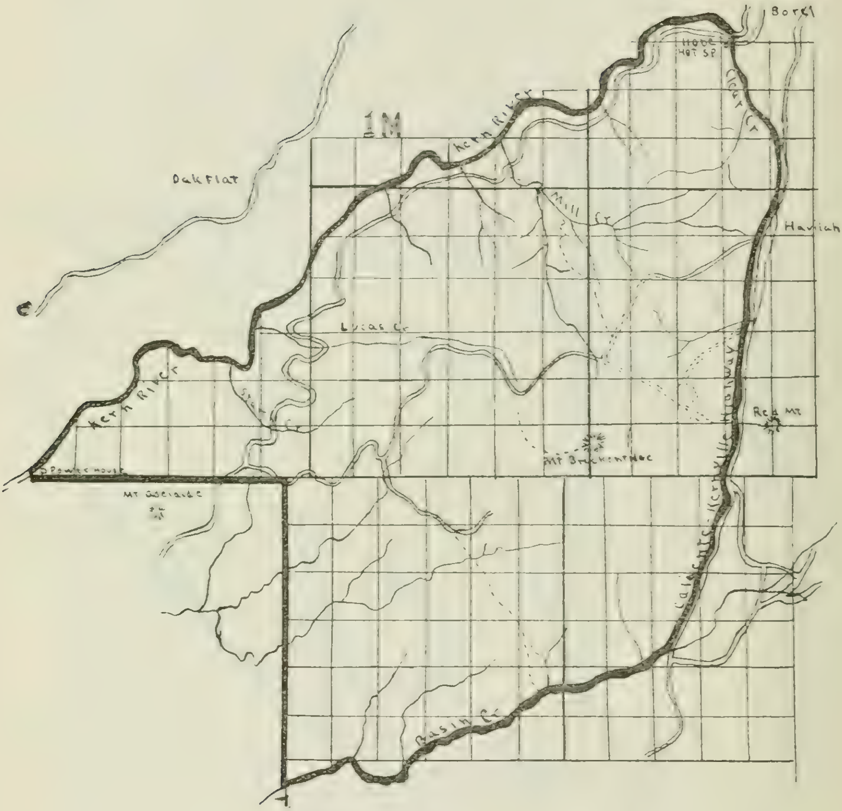


FIG. 17. Fish and Game District 1M, an area surrounding Mount Breckenridge in Kern County, was recommended by an association of Kern County sportsmen and was set aside by the legislature of 1919. It furnishes a sanctuary for deer and also for small game. Concentrated hunting in the vicinity made the setting aside of this refuge urgent.

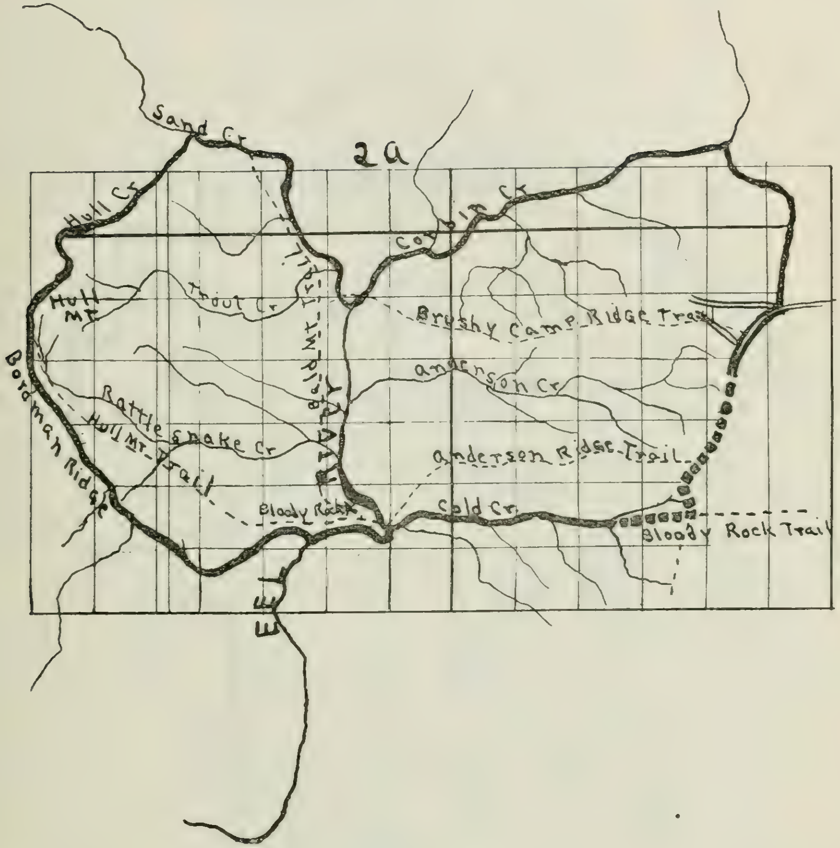


FIG. 18. Game Refuge 2A, situated in Mendocino and Lake counties, comprises a rough area on the watersheds of Anderson Creek, Rattlesnake Creek and Trout Creek, and part of the watersheds of Cold Creek, Corbin Creek and Sand Creek, tributaries of South Eel River. The elevations range from 2600 feet to 6875 feet on Hull Mountain on the west side of the area. The most important game in this refuge is deer, the area being well adapted as a breeding ground for this species. Black bear find protection, also. A few mountain quail and a few grouse are to be found on the higher parts of the area, and a few coveys of valley quail at the lower elevations.

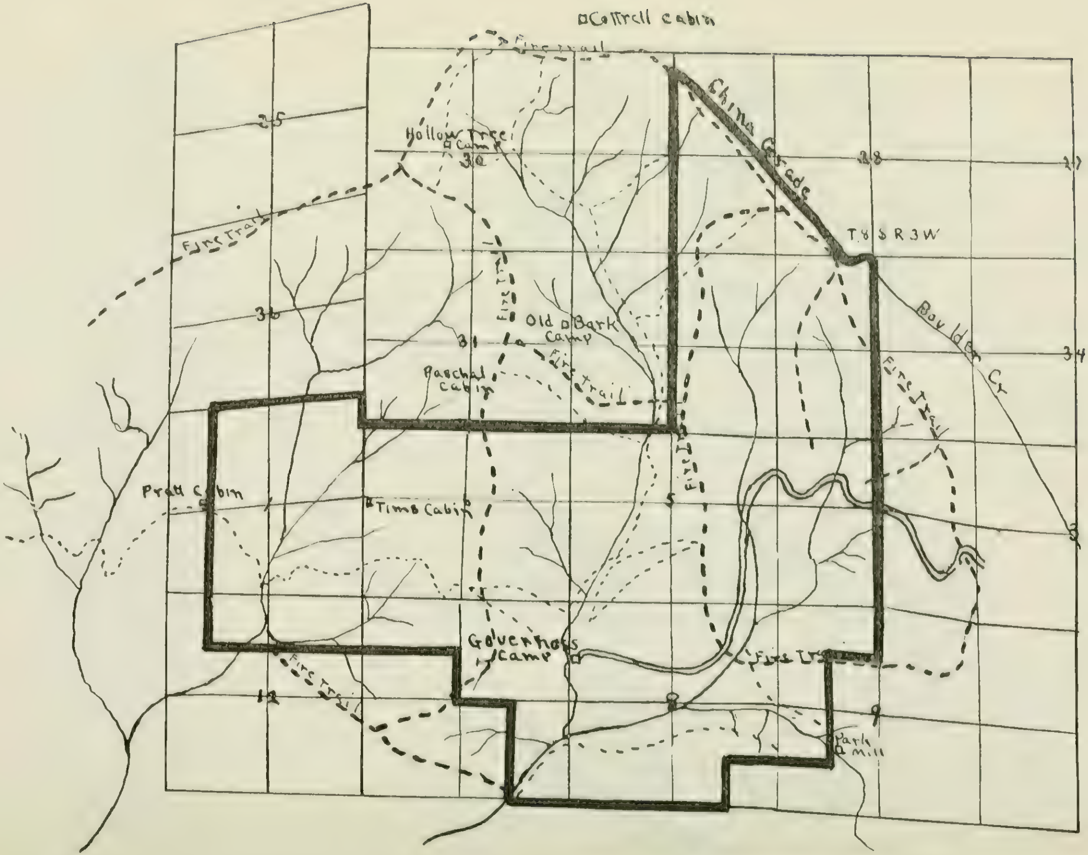


FIG. 19. Fish and Game District 3A comprises the State Redwood Park in Santa Cruz County. This is one of the smallest of the refuges but appears to furnish a safe retreat for many deer. So tame have the deer become within this area that they come at the call of the keeper and feed from his hand.

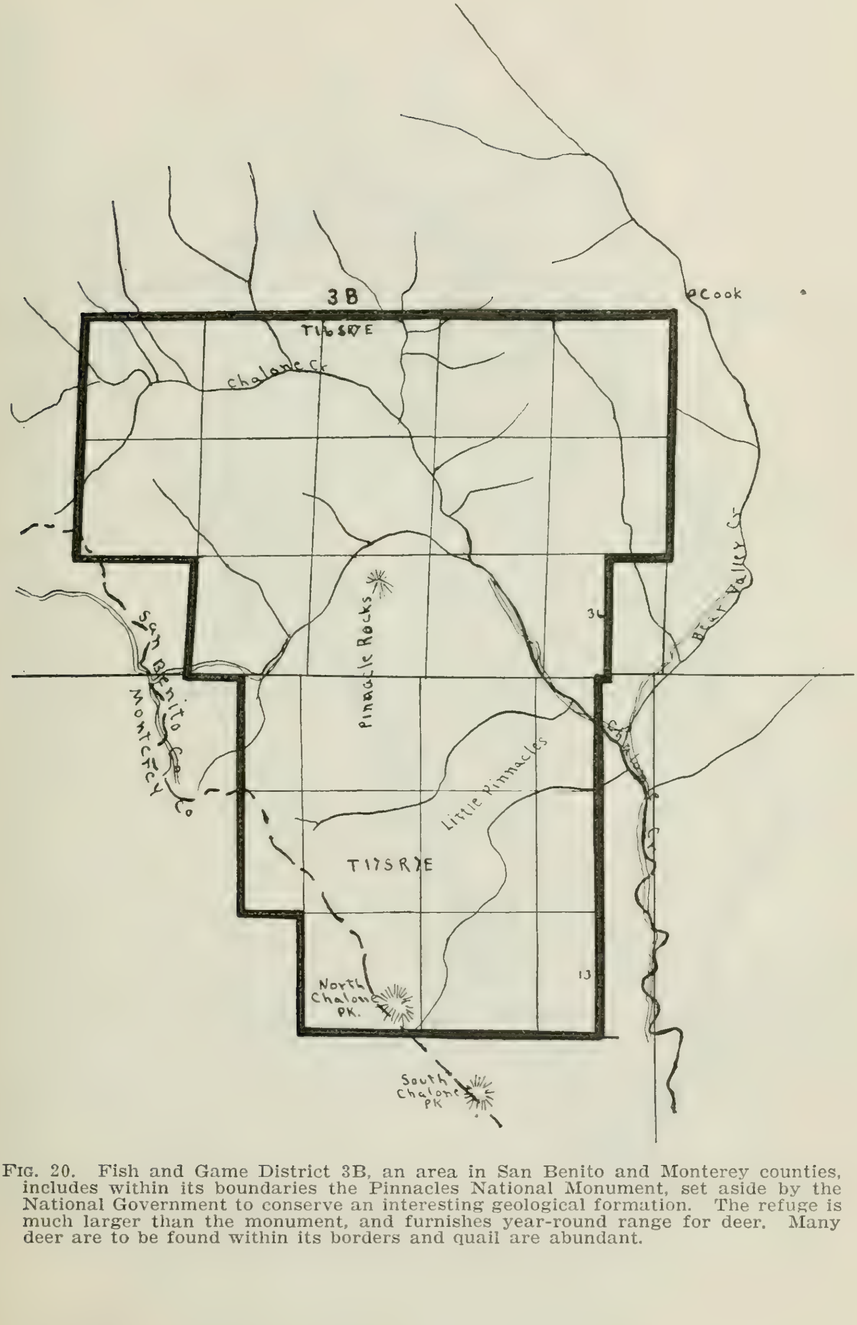


FIG. 20. Fish and Game District 3B, an area in San Benito and Monterey counties, includes within its boundaries the Pinnacles National Monument, set aside by the National Government to conserve an interesting geological formation. The refuge is much larger than the monument, and furnishes year-round range for deer. Many deer are to be found within its borders and quail are abundant.

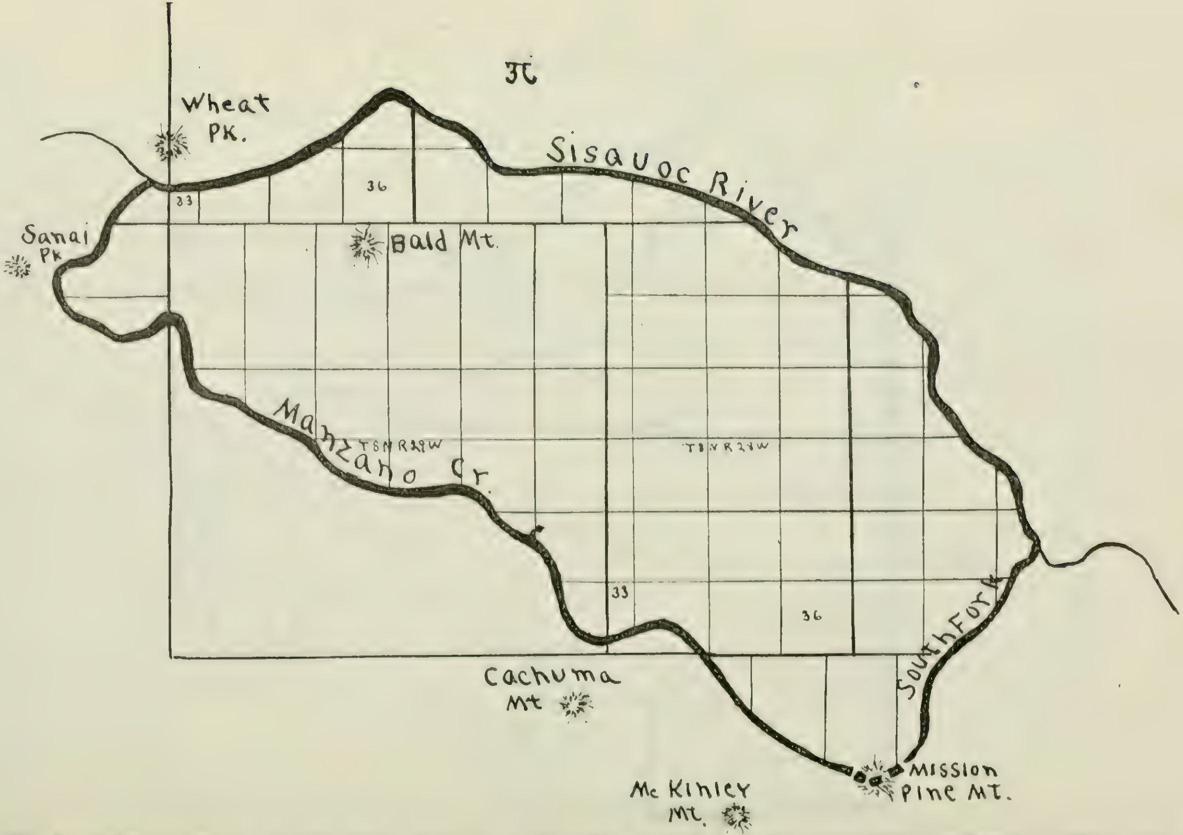


FIG. 21. Fish and Game District 3C is composed largely of a rugged ridge situated between the Sisquoc River and a large tributary known as Manzano Creek in Santa Barbara County. Numerous small canyons are tributary to these dividing streams and furnish shade and water. Numerous springs are also to be found. The cover is principally chapparal with patches of oak timber. Year-round range is furnished for deer, and quail and wild pigeons also find protection within the refuge.

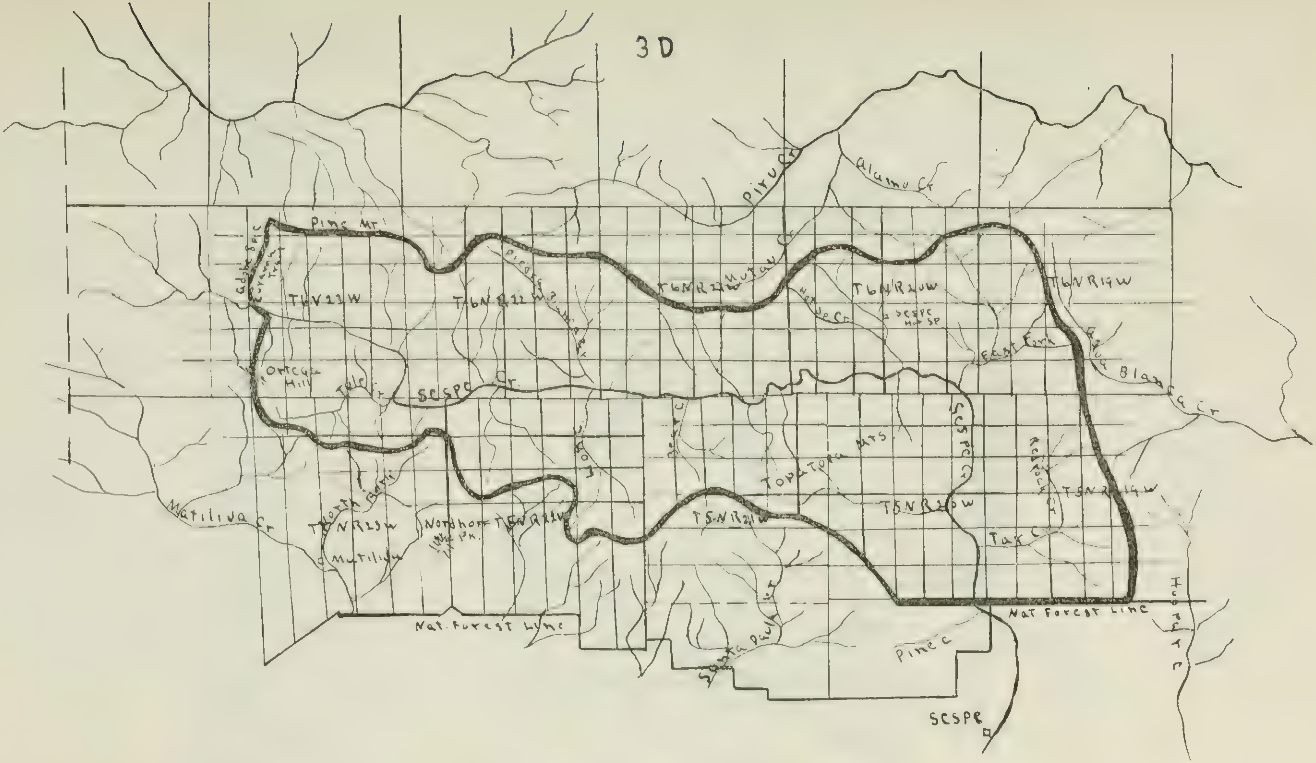


FIG. 22. Fish and Game District 3D lies in Ventura County, and comprises most of the watershed of the Sespe River where it runs in the mountains. The entire area is covered with brush, there being a small amount of pine and fir timber on the summit of Pine Mountain, and scattered forested areas in the canyons. Deer, bear, quail, and wild pigeons find protection on the area.

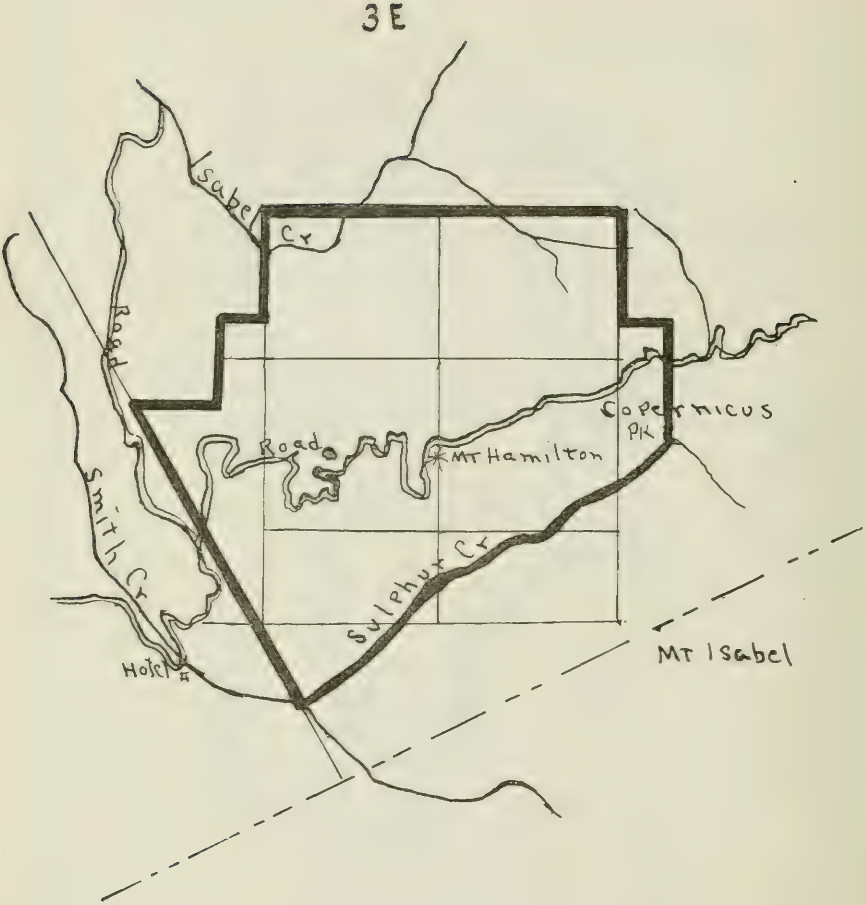


FIG. 23. Fish and Game District 3E comprises an area surrounding Mount Hamilton in Santa Clara County, being the land owned by the University of California, on which the Lick Observatory stands. This was formerly one of the favorite hunting grounds for sportsmen from San Jose, and should afford additional needed protection to the deer in that vicinity. Since the creation of this refuge, deer have increased within its boundaries many times.

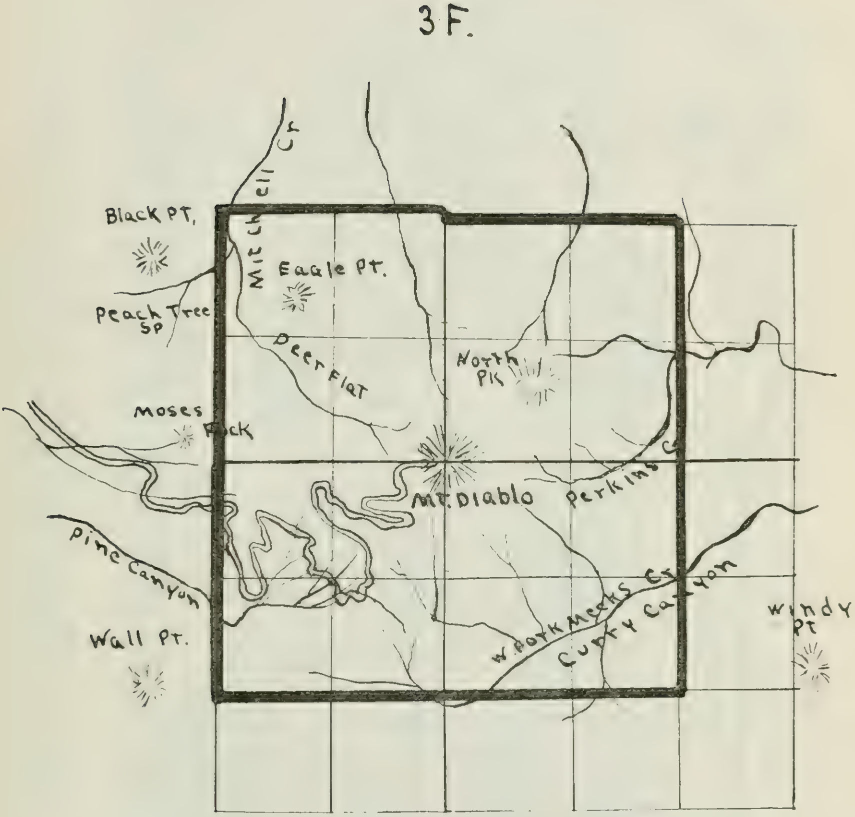


FIG. 24. The most recent refuge to be established is the Mount Diablo Park Refuge, set aside by the 1921 Legislature as Fish and Game District 3F. An attempt has been made during the past few years to improve game conditions on the mountain, and consequently there is already a supply of deer and a splendid supply of quail within the boundaries. Undoubtedly the deer will soon learn that they are safe within the area, with a resulting increase because of the safety afforded. In the end an overflow from this safe breeding place will furnish plenty of sport in the hunting territory. That sentiment strongly favored the creation of this refuge is evidenced by the small number of violations during the past year.

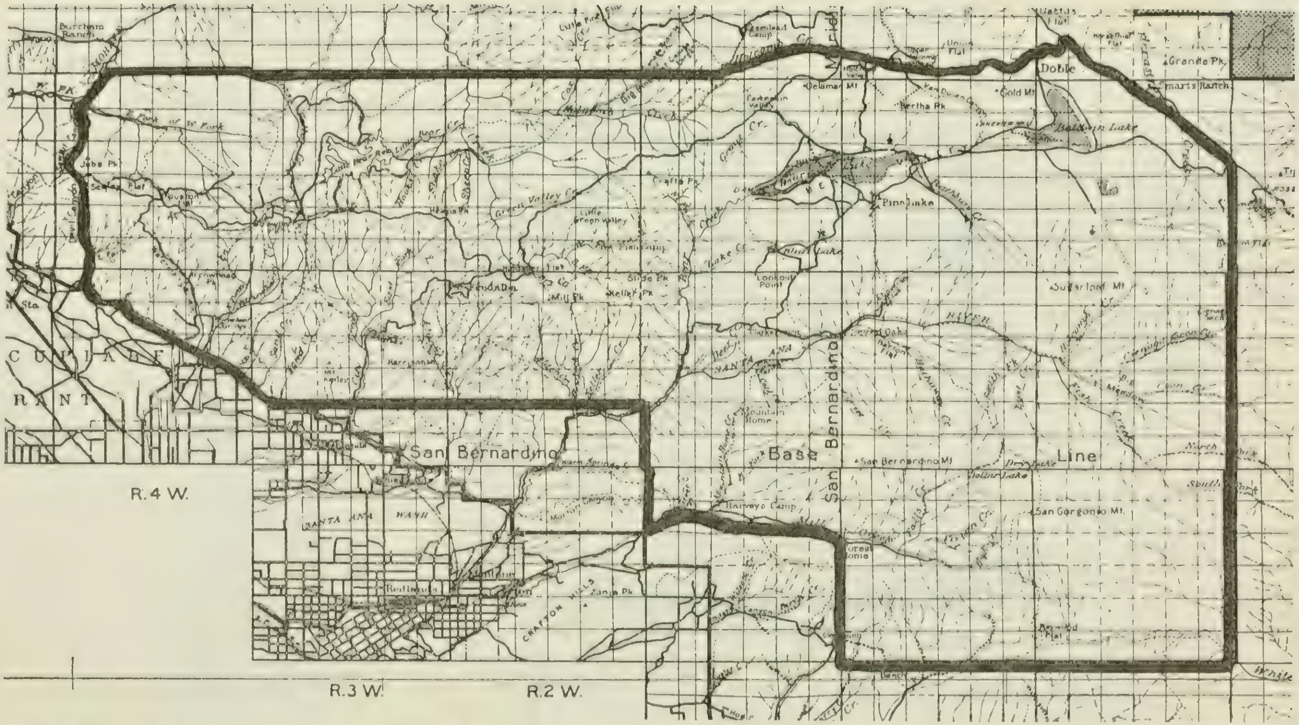


FIG. 25. Fish and Game Districts 4A and 4B, in the Angeles National Forest, taken together form the largest refuge in the state. The concentrated hunting in past years, due to accessibility from Los Angeles, reduced deer and other game to the danger point, and made these large refuges a necessity. Although there is some complaint that these areas are too large and usurp too much of the hunting grounds, yet most sportsmen agree that these areas are serving their purpose.

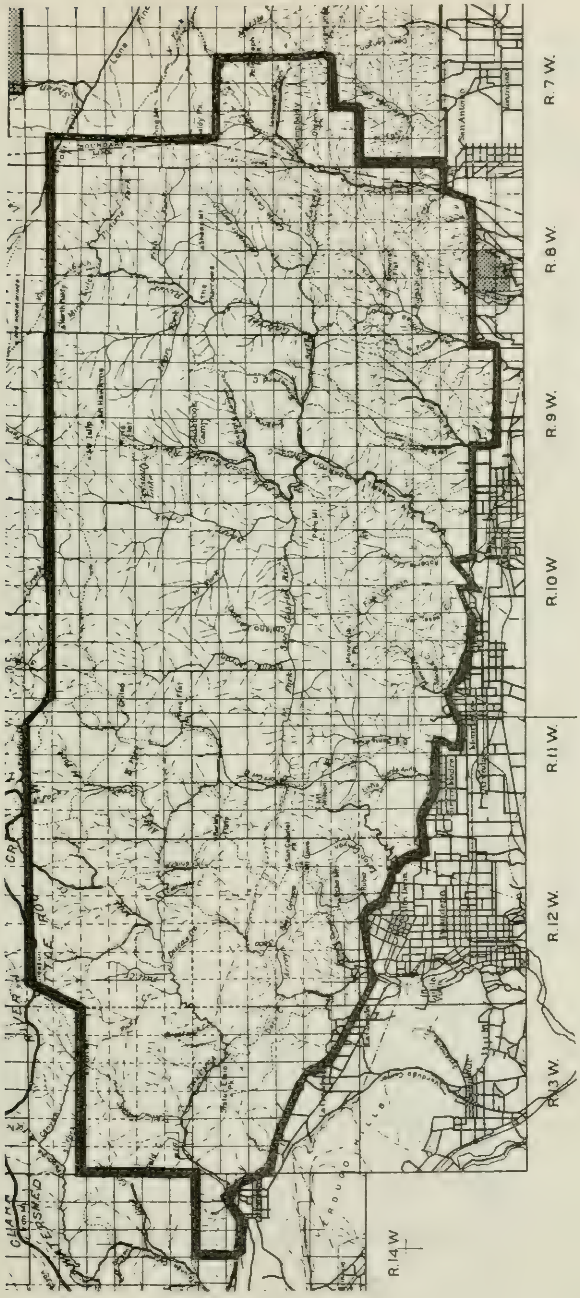


FIG. 26. Fish and Game District 4B. For description see Fig 25.

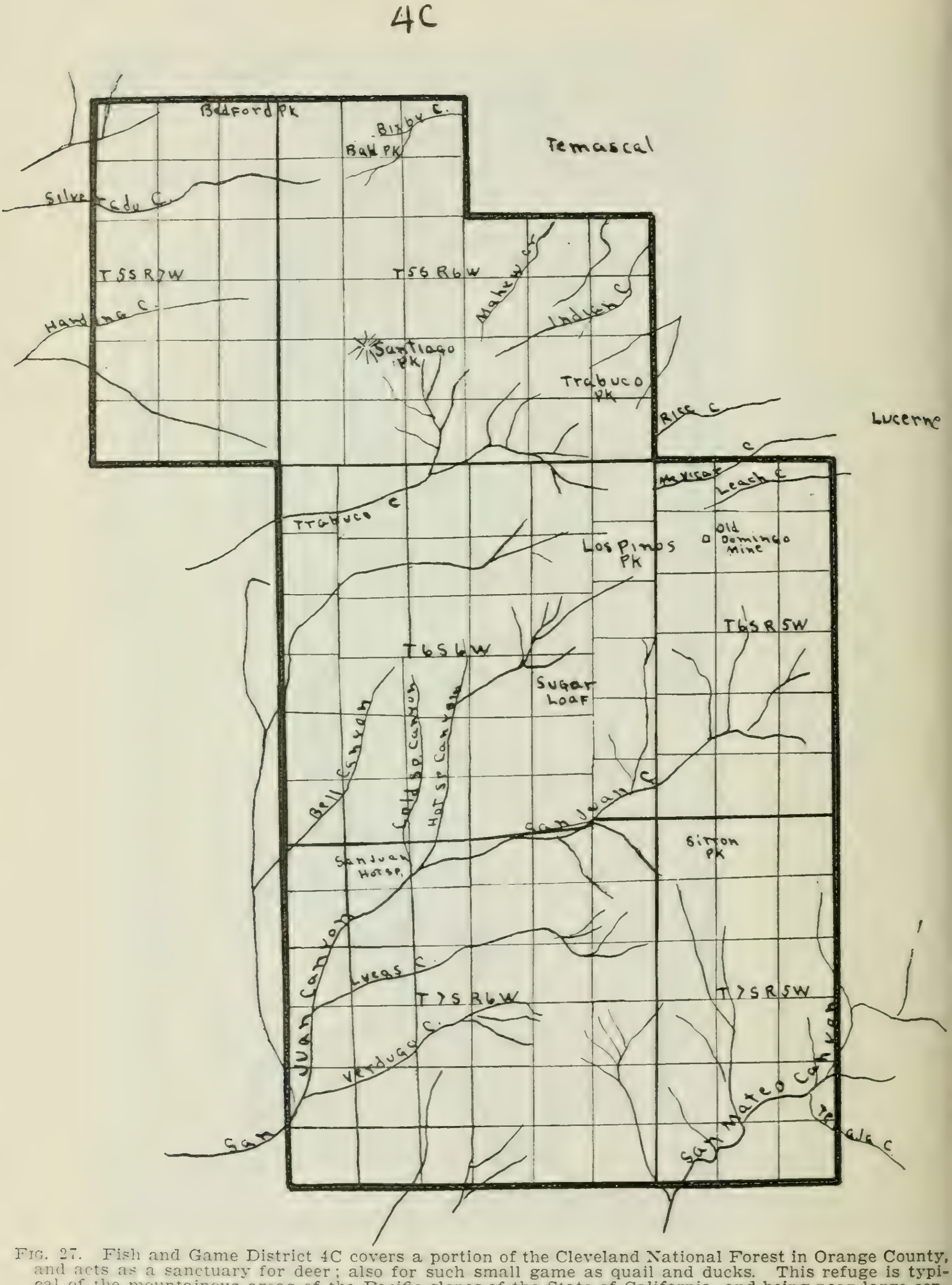


FIG. 27. Fish and Game District 4C covers a portion of the Cleveland National Forest in Orange County, and acts as a sanctuary for deer; also for such small game as quail and ducks. This refuge is typical of the mountainous areas of the Pacific slopes of the State of California, and being near large centers of population, the need for its establishment was apparent in 1913.

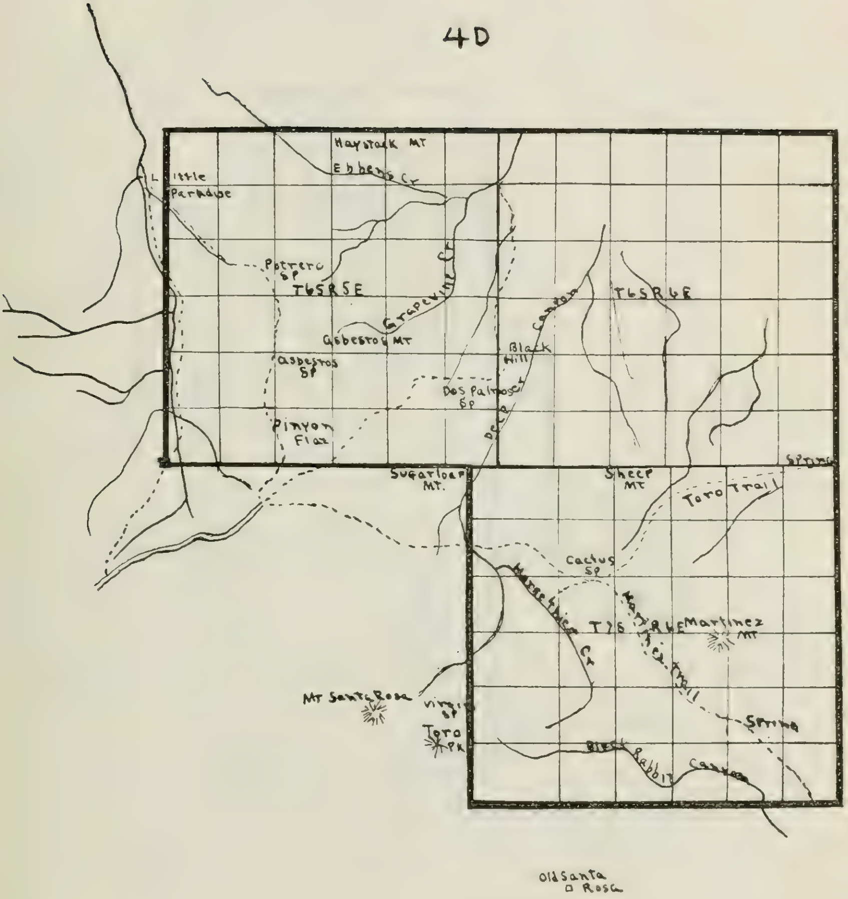


Fig. 28. Fish and Game District 4D, situated in the Santa Rosa Mountains of Riverside County, was created primarily to furnish increased protection to a band of mountain sheep that range over this territory. It is in reality the only refuge in the state which is distinctly for mountain sheep.

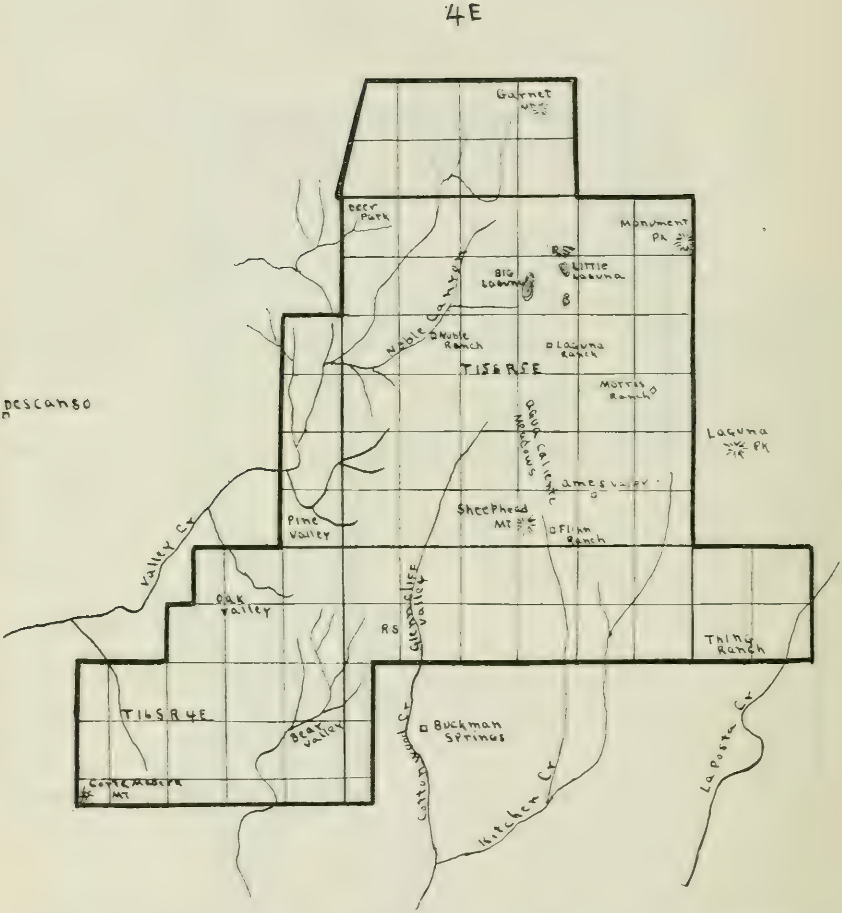


FIG. 29. Fish and Game District 4E comprises the slopes of Laguna and Corte Madera Mountains in San Diego County. The slopes are steep and covered with brush. A few small canyons containing running water make the area especially suited for deer and quail. Public sentiment has been strongly in favor of this most southern of the game refuges.

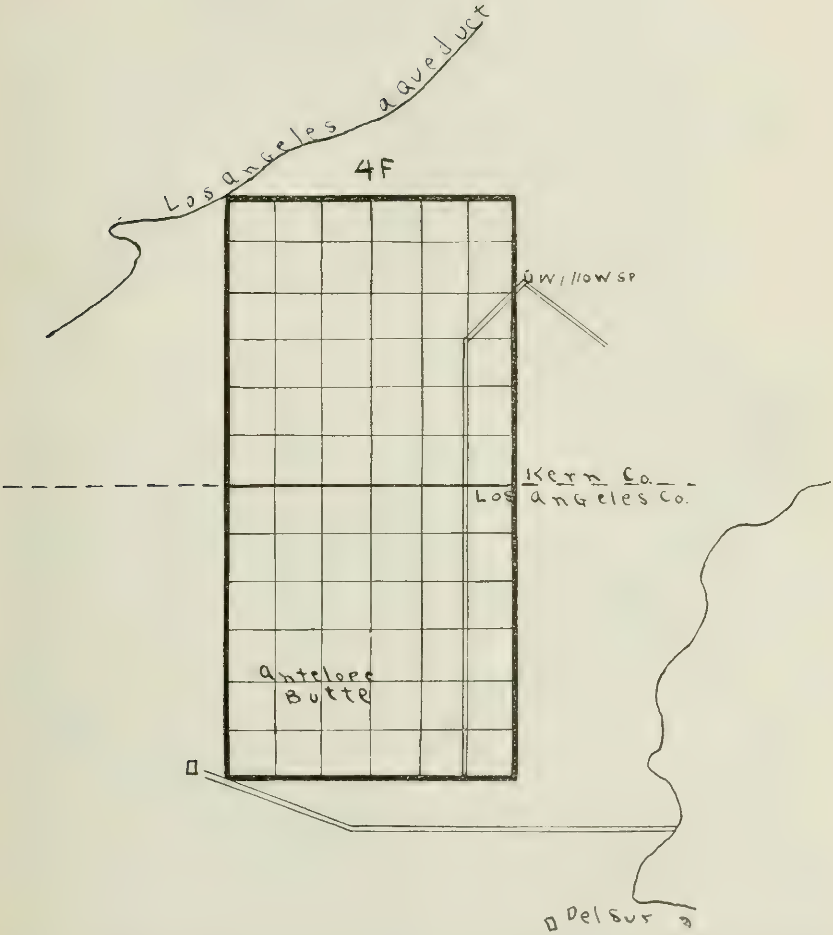


FIG. 30. Fish and Game District 4F, in northern Los Angeles and southern Kern counties, was set aside principally to better conserve the small remnant remaining of the once large herds of antelope which formerly ranged in this region. It can be considered primarily an antelope refuge.

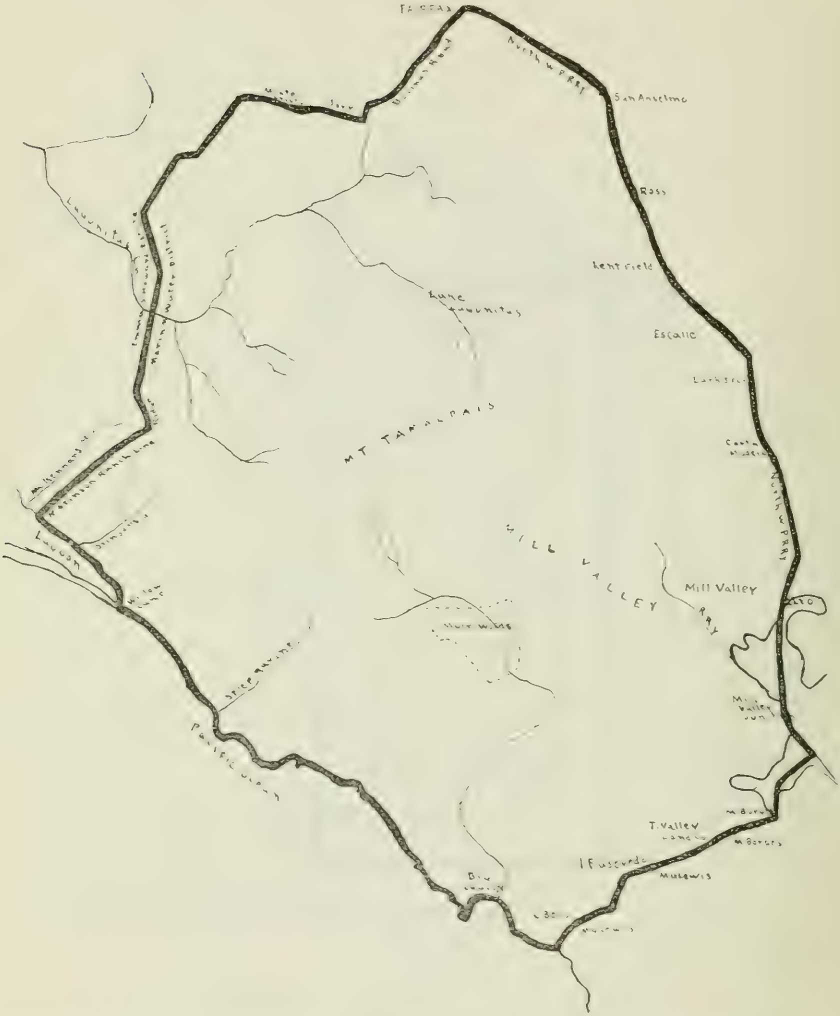


FIG. 31. Mount Tamalpais Refuge furnishes one of the greatest problems in the matter of administration. This refuge in Marin County lies close to a center of population and for years the area has been the recreation ground for thousands of San Franciscans. Before the refuge was established many were accustomed to carry firearms with them on their week-end trips, some for target practice and many for game shooting. As a consequence it has been difficult to apprehend everyone carrying firearms through the refuge. Two of the deputies from the Commission, during the year after the creation of this refuge, confiscated nearly a hundred firearms in a single day from vacationists within the refuge. If the thousands utilizing the Tamalpais Refuge as a recreation ground can be educated to the value of this refuge, it will become a very important one. Deer are numerous within its borders and there should be a sufficient overflow into the open hunting grounds to the north for many years to come.

A PIONEER ELK HUNT.*

Early the next morning we started again and at sunset, after a hard day's travel, by bye-paths, arrived at the rancho of Rafael Garcia. * * *

After enjoying Garcia's hospitality for the night, we found, on rising next morning, several of the neighboring rancheros, who had arrived on their way to the Punta de los Reyes, for the purpose of hunting the elk, with which it abounds. Sending all my men except two back to Sonoma, I resolved to remain and witness the sport, and getting fresh horses from Señor Garcia, we started for the point. I observed that the Spaniards had no arms, but they pointed to the riata, the unfailing companion of all rancheros, and exclaimed, ''este es el rifle del ranchero!''—this is the ranchero's rifle. On our way, however, I observed one of the party dismount near a small grove, and selecting a straight, light pole, take from beneath his sarape a crescent-shaped weapon, which he fixed to the top of the pole. This instrument they call, from its shape, the ''luna,'' and it is used for hamstringing the elk, which then falls an easy prey to the hunter.

The cool, bracing air of the morning promised us fine sport, as the horses, on whose exertions the sport mainly depends, would not be exhausted from the heat. But, as the Irishman devoutly remarked, ''Providence never opens one door but it shuts another,'' a reflection verified in the present instance by the rising of a dense fog, which prevented us from seeing any considerable distance and forced us to be circumspect in picking our way over a very broken and hilly part of country. Crossing a deep valley, up which I could not see for the mist, we surmounted a high hill, and I saw in a moment that we stood on an isthmus or neck of land, connecting a lofty promontory—lying right before us—with the mainland. At the same time I discerned the sea on either hand, and heard the musical roar of the surf, as it tumbled ashore on the right. Suddenly one of my men exclaimed, in a low tone: ''Hush!'' and, rifle in hand, dismounted for a shot. Following the direction of his glance, toward the promontory, I perceived a band of elk which must have numbered not less than four hundred head of superb fat animals—the apparently cumbrous horns of the bucks thrown back on their shoulders, and the leaders seeming to hesitate whether it should be a fight or a foot race. Pacific councils, however, prevail, and the whole body were soon in full retreat, the old bucks occasionally stopping to gaze at us, while the does and fawns made the best of their way up the slope. Our horses scenting them at the same time—for the horses of California scent large game almost as acutely as dogs—became greatly excited, and could hardly be checked from dashing forward in pursuit.

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*This account of an elk hunt at Punta de los Reyes, Marin County, in August, 1846, was written by Joseph Warren Revere, an American naval officer and a direct lineal descendent of Paul Revere, of Revolutionary times. He took an active part in the conquest of California and raised the American flag at Sonoma, California, and was its first American alcalde. He was once the owner of San Geronimo Ranch in Marin County. The article appeared in "A Tour of Duty in California," published in New York in 1849. The interesting description of the hunt fortunately overshadows the harrowing details regarding wounded animals, and the killing of a fawn, which the author includes.—Editor.

The rancheros seemed to despise the stealthy advance on foot of the Americans with firearms, and as the game could not escape us, being surrounded on all sides by the sea, except on that occupied by our well mounted party of six men, they planned a mode of attack, which they communicated to us. Two of them gave their horses the rein with an "adelante!" and the noble beasts sprang forward in full pursuit of the now flying herd. At this season (August) elk are fatter than at any other, and can not compete with the horse in speed, whereas, a couple of months later the fleetest horse could hardly overtake them. Their speed was now inconsiderable, the rancheros soon coming up with them and scattering them in various directions. Our friend with the "luna" had hamstrung several of the poor creatures and his companion had entangled with his riata a noble buck, which was plunging and tearing violently, the riata being at its greatest tension and the little horse, to whose saddle it was made fast, standing stiff and stark with eyeballs staring, and every nerve braced to meet the pulls and tugs of the elk; while the Californian sat coolly in his saddle and, addressing the elk by the familiar title of "cuñado" (brother-in-law), pleasantly assured him that he "only wanted a little of his lard wherewithal to cook tortillas!"—a joke which the struggling victim was in no humor to relish.

From the contemplation of a scene so new to me, I was aroused by Don Egedio (Giles), who loudly called to me to shoot, and, turning my horse, I spurred him nearer the precipice, between which and myself the remainder of the band seemed disposed to rush, on their way back to the mainland. My horse was an admirably trained animal for the purposes of hunting after the fashion of California, but he would not stand still enough for a shot from the saddle; and to have dismounted would have been to lose him, as he would have pursued the elk. But a shot I was determined to have, on some terms, and so, when it seemed to my rather obfuscated vision that I was opposite the thickest of the band, I wheeled, seized my double-barreled gun, and pulled both triggers at a venture. My horse, unused to fire, jumped some twenty feet, more or less; I dropped my gun but kept the saddle. My shot accidentally took effect, for when I was able to rein up, I returned to the spot and saw a poor doe lying in a reclining position, the blood welling rapidly from the frightful wound inflicted by two heavy buckshot cartridges which had taken effect in the animal's shoulder. The unfortunate fixed upon me her large full eye, expressive at once of fright, sorrow, and reproach, and the mournfulness of the scene was heightened by the presence of a half-grown fawn, baaing and bleating around its dying mother. Sentiment, however, soon subsides on the hunting ground, and after my friend with the "luna" had coolly drawn his knife across the throat of the doe, I felt little compunction in bringing down the sorrowing fawn. In the meantime our friends on the point had not been idle, having taken toll of two more of the flock as they passed, one of which was caught with a riata by a Spaniard and an Indian vaquero, and the other shot by one of my men. It usually requires two men with riatas to kill the animal, the object being to trip him up and then give him the coup-de-grace; but one man sometimes does it alone with a riata and luna, and there are rare instances when a single expert hand trips up the animal with his riata and then finishes him.

The herd had now retired to the mountains, and were dispersed among the crags and precipices, almost inaccessible to horses. Our party collected and rode down the point, where we found three hamstrung animals which had wriggled and screwed themselves into the most retired places. Our friend of the "luna," however, insisted with many round, full-mouthed oaths, that he had disabled nine and wounded some others in a desperate manner, with the points or horns of his iron. But these people can not be implicitly believed, and after traversing the point in every direction, we could find but one more elk, which had fallen over the precipice and lay half his length in the sea, the vultures and sea-birds already hovering over him in great numbers, impatiently awaiting the moment when death should make him their own.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

FEBRUARY 3, 1922.

"One thing now should be apparent to the dullest mind. It is that unless a great number of game sanctuaries are made and maintained inviolate for the safe breeding and increase of big game, the noble sport of big game hunting will be a thing of the past."

DO WE NEED MORE GAME REFUGES?

A survey of the game refuges in California will show that they are numerous, well distributed, and that many of them are of large size. Whether the policy of creating such refuges should be continued or ended, is a question which needs to be fully considered at the present time. On the one hand there is complaint by many hunters to the effect that all of the good hunting grounds are now within game refuges; on the other hand there is demand from conservationists for increased protection. Possibly the most dependable conclusion will be forthcoming after the test of time has been applied. Should the present refuges be able to maintain big game in sufficient numbers, the matter would be settled.

Some states have adopted the slogan: "A refuge for every county" or even "A refuge for every township," and it may be that the conservation of upland game birds demands the creation of a large number of small refuges. Our obligation to big game, however, seems to be satisfactorily met in the present series of twenty-eight refuges, most of them set aside especially for big game.

INTERNATIONAL BIRD PROTECTION.

The apparent benefits accruing from the joint protection given migratory birds in Canada and the United States has promoted discussion as to the possibility of arranging treaties with other countries of Central and South America, in order to secure such protection for migratory birds in those countries as is afforded them in North America under the existing treaty between the United States and Great Britain. In January, 1920, a resolution was presented to the President by the Committee on Foreign Relations, asking that a treaty be proposed between the United States and the Latin-American republics for the protection of birds which migrate between the United States and such countries.

The President, acting on the report of the Secretary of State, and also the report of the Secretary of Agriculture, stated that in view of existing conditions the time did not seem opportune to undertake the negotiation of a treaty for the protection of migratory birds with the Republic of Mexico, and that in the case of most of the republics of Central and South America treaties are unnecessary at present, although in the case of Brazil and Argentina such treaties might be of advantage.

In order to obtain more definite information before the negotiation of conventions with these countries was undertaken, Dr. E. W. Nelson, Chief of the United States Biological Survey, sent an agent to Argentina, Uruguay, Paraguay and southern Brazil for the purpose of securing needed information concerning the conditions relating to such of our migratory birds as winter in those regions. Further steps looking toward the execution of treaties with these countries will depend on the report of this agent.

IMPORTANT CONVICTION SECURED.

The Fish and Game Commission recently secured a conviction in an important case involving the violation of the law relating to the taking and shipping of trout. This case is of interest to all who favor the enforcement of the fish and game laws of the state, and especially to those who are aware of the amount of time, money and labor spent in propagating trout and supplying the streams with this gamey fish.

For several months the Commission worked quietly but effectively on an investigation of the violation in question, and the result was the apprehending of two Alameda gentlemen who had for some time been sending packages of smoked trout through the mails from Tuolumne County, thus laying up a private supply of fish for their use during the winter. Simultaneously with the seizure of two boxes of fish as they reached their destination, the two men, with 50 trout in their possession, were arrested in Tuolumne County by a Forest Service deputy. This evidence, taken together with the trout in the two boxes, confirmed the suspicion that these parties were in the habit of taking trout beyond the legal limit.

The case was tried before Judge Wilkinsky of Sonora, and the court fined each offender $75 for exceeding the bag limit and $25 each for shipping the two boxes of smoked trout to Alameda by parcel post. Later a search was made of the residence, where about 200 smoked trout were found and confiscated.

It may be well to state that the law provides that a fine of $25 may be imposed for each lot of fish or game shipped by parcel post, and from $25 to $500 for any catch in excess of the limit, or imprisonment of not more than 150 days, or both. The Fish and Game Commission has the right to inspect the offices of express companies, although there is no provision in the law giving the right of access to post offices.

HUNTING ACCIDENTS—1921.

Since the publication of the note regarding hunting accidents in the last number of CALIFORNIA FISH AND GAME, there has appeared what may be called almost an epidemic of hunting accidents. Judging by newspaper accounts, hunting accidents have been more numerous during the last year than for several years past, as a compilation of the accidents coming to our attention shows. Undoubtedly this compilation is incomplete, as newspaper items have formed the only source available, since hunting accidents are not distinguished from other accidents in the statistics of the State Board of Health. The list is published as a warning to those who go afield with a gun. If simple warning of danger is not effective in reducing the number of hunting accidents, it may be that the sight of a long list of persons actually killed and numerous others wounded, through their own or some one else's carelessness, may impress persons with the need for great precaution to avoid the taking of human life.

HUNTING ACCIDENTS, 1921.

Killed.

Name	Shot by	Date, 1921	Locality	How shot
James Anderson (11)	Self	October 15	Marshes, Seminary Ave., Oakland	In effort to repair gun, Anderson looked into muzzle of gun, which accidentally discharged, resulting in instant death.
David Hoover	B. J. Blaze	September 11	Bell Station, Santa Clara County	Mistaken for a deer.
Clifton Madison (13)	Self	September 21	Leona Heights, Oakland, Alameda County	Accidental discharge of gun while climbing out of abandoned mine shaft.
George W. Staton	Richard Williams	October 1	Suisun Marshes, Solano County	Duck hunting. Victim stood up in motor boat just as companion fired at flock of birds.
Jack Swartz	Red Hall	October 6	Bakersfield, Kern County	Mistaken for a deer.
L. R. Samson	Self	September 11	Ukiah, Mendocino County	Accidentally discharged gun on return from hunting trip.
Charles O. Berwick	Self	November 27		Accidental explosion of gun wounds arm and hand, death resulting from infection.
Gordon H. Sawyer, Jr.	W. L. Minaker	December 4	Woodland	Hunting in rice fields, gun accidentally discharged.
Alfred C. Musso (17)	Self	November 5	Bowman, Placer County	Grasped gun by the muzzle and beat the bushes with the butt to scare out the quail.
Anker Boegh (19)			Franklin, Sacramento County	Gun in front seat of automobile exploded, resulting in instant death.
George Granelli (11)	Self	December 22	Sherman Island, Sacramento Co.	Accidental discharge of rifle while hunting ducks.
John Pellester	Self	December —	Helena, Trinity County	Slipped in snow and accidentally discharged gun while hunting panther.

Wounded.

Name	Shot by	Date, 1921	Locality	How shot
Dillion Allard	Self	August 21	Ukiah, Mendocino County	Accidental discharge of pistol; leg wounded.
George Shellford (14)		August 1	Pine Flat, Sonoma County	Accidental discharge of rifle.
Robert Clark, Jr. (16)	Companion	August 3	Ventura County	Shot in the hip by companion while hunting deer.
Norman Donohue (15)	Self	March 20	Ventura County	Arm shot off half way between elbow and wrist, as he was crawling through a fence in the river bottom.
James Nelson	Harry Moore	October 1	Newman, Stanislaus County	Companion stumbled and fell, gun discharged hitting Nelson in leg. "Dangerously hurt."
Robert Skinner	H. H. Spangle	September 9	Helena, Trinity County	Mistaken for a deer. Tore hole in arm and wound in side.
Prof. J. G. Brown,	Mr. Bassett	September 23	Near Redding, Shasta County	Mistaken for a deer.
Emmet Frye (14)	Father	September 8	Stonyford, Colusa County	Mistaken for a deer.
Frank Miller (16)	Self	March 28	Martinez, Contra Costa County	Accidentally discharged gun. "Will not likely recover."
J. T. Zirling (20)	Unknown		Near Auburn, Placer County	Stray shot passed through lung.
Homer Smith, (19)		November 24	Antioch, Contra Costa County	Accidentally shot in the leg while hunting. "Amputation found necessary."
K. I. Schofield	Self	September 3	Santa Barbara County	Shot in arm while attempting to pull gun through fence.
M. Fontaine		November 4	Calaveras Valley	Thrown from motorcycle when machine skidded and ran into brother's car. Victim's back broken.
Tony Marvinna	Frank Sepada	August 5	Upper Bayo, east of Mount Hamilton, Santa Clara County	Mistaken for a mountain lion.
Frederick K. Burkett (15)	Ed. Maurrer	September 13	East of Mount Hamilton, Santa Clara County	Mistaken for deer. Spinal column injured, resulting in complete paralysis of the lower limbs.

"PUBLIC SHOOTING GROUND-GAME REFUGE BILL."

Through the enthusiastic and timely efforts of sportsmen and the cooperation of Congressmen and Senators, there has been introduced and is now pending before Congress a bill known as the "Public Shooting Ground-Game Refuge Bill"—a bill on which the future of the sport of duck shooting depends. These men have realized that because of the disastrous results from inadequate game protection, it has become most essential that suitable territory shall be set aside for all time to come, to act as breeding, feeding and resting places where birds are free from molestation, if the birds and the sport of shooting them are to be perpetuated.

The main provisions of the bill include the establishment of shooting grounds for the public, the establishment of game refuges and breeding grounds for protecting migratory birds, and a federal license to hunt migratory birds.

The federal license of $1 is to be paid by the sportsman who hunts migratory birds, and not by the taxpayer, and is to be issued by any postmaster. It shall become void after the thirtieth day of June, next succeeding its issuance.

The federal license will in no way supercede the state license or relieve the gunner from his obligations to his state laws. The funds derived from the license sales are to be used for the purchase or rent of refuges and shooting grounds where territory is available and where the greatest good will result. The shooting grounds will, of course, be distributed as equally as possible over the different states, depending upon available areas that are suitable.

The bill further provides for the creation of a commission to be known as the "Migratory Bird Refuge Commission" to be composed of the Secretary of Agriculture, the Attorney General, the Postmaster General, two members of the Senate (to be selected by the President of the Senate) and two members of the House of Representatives (to be selected by the Speaker), to arrange for the purchase or rental of the refuges and hunting grounds; which commission is to make an annual report of its activities and expenditures to Congress.

Any employee of the Department of Agriculture, authorized by the Secretary of Agriculture to enforce the provisions of this act, is to have power to arrest without warrant any violators he may apprehend, and with warrant to search any place.

Any violation of the act, or any regulations made pursuant to the act, shall constitute a misdemeanor and shall be subject to imposition of a fine of not more than $500, or to imprisonment for not more than six months, or both.

NOTABLE ARRESTS AND CONVICTIONS.

Deputy Burke recently apprehended two men in San Mateo County, killing deer at night with a spotlight. A jury trial before Judge Johnson resulted in fines of $200 each for the men. Notice of appeal has been filed by the defendants.

Deputies in various parts of the state have recently made many arrests for the taking of game fish between an hour after sundown and an hour before sunrise. Fines have been imposed in every case.

In September an Italian in San Mateo County was arrested by Deputy Burke for having in his possession quail and non-game birds. Judge Griffin fined the man $200.

Deputies in the duck section of the Sacramento Valley have made numerous arrests for night shooting and over-the-limit of ducks. Fines ranging from $50 to $200 have been imposed.

Deputy Atkinson recently arrested a man for killing deer within Fish and Game District 4C, a game refuge in Orange County. Judge Cox of Santa Ana imposed a fine of $100.

Deputy Bundock recently apprehended a hunter with a doe in his possession. Judge J. S. Fitzgerald of Livermore imposed a fine of $150.

Deputy Tibbetts arrested two parties for having in possession eleven quail within Fish and Game District 1M, a game refuge. Judge F. Bunnell fined each $100.

On October 30, Deputy Armstrong and Deputy Steele arrested eleven men for shooting from power boats. Judge Prince of Benicia fined each $25.

A fisherman was apprehended by Deputy Sherwood with over-the-limit of salmon and was fined $100 by Judge W. S. Rice of Modesto.

Two duck hunters with over-the-limit of ducks were arrested by Deputies Britton and Carpenter on November 26. Judge Farnum of Willows, finding them to be old violators, fined each $100.

Fines of $25 each were meted out to five men found night shooting by Deputy Ludlum and Deputy Stanley.

On November 11, Deputies Willard, Britton and Carpenter arrested two market hunters found night shooting. Each was accorded a fine of $100 by Judge Farnum of Willows.

Forest Deputy N. Phillips arrested N. Alvarez for taking fish with an explosive in Madera County on August 28, 1921. Judge Bennet of Madera sentenced the violator to 100 days in jail.

"SAVE NOW OR LOSE FOREVER."

Such an excellent editorial on the subject of protection and conservation appeared recently in "*The Gull*" (Vol. 3, No. 11, pp. 3–4) the publication of the Audubon Association of the Pacific, that we wish to quote a few extracts therefrom. The editorial was incited by an article appearing in the bulletin of the Audubon Society of New Hampshire.

Attention is strongly drawn to the fact that "the trees of our forests need the birds even more than the birds need the trees." "This matter of interdependence of plant growths and birds upon each other is one which escapes the notice of most people and the most serious task confronting Audubon societies today is to bring this point home to every community and every family and to every individual." The average man is in great danger of losing sight of the damage which will be done by the insects which would have been disposed of if certain useful birds had been spared instead of being so thoughtlessly killed because of a slight personal loss in fruit or grain.

> "Man can protect his orchards and city shade trees to some extent by the expensive process of spraying, but when it comes to all the trees in all the woods, he is powerless. We see his helplessness in the case of fungi diseases, such as the chestnut blight and the white pine blister rust."

Vast sums of money have been expended by the government in an effort to check these agents of destruction, and vast sums must still be expended and many years spent in a further effort to control the situation.

> "So we can easily appreciate the impossibility of man's efforts being able to check insect depredations in our forests.
>
> "The cycles of Nature are vast; the life of man, short. Everything he requires, save air and water, is limited and measured out to him, but he is only now beginning to concern himself with the diminutions which have resulted from his own recklessness and waste. In so far as living organisms are involved in these problems, future generations will be fortunate indeed if they progress rapidly enough in knowledge and intelligence to identify the interrelation of living things in time to preserve those forms which are essential to their own well-being. Up to the beginning of the present century, we have fatuously confined our researches to the discovery of substitutes for what we have wantonly destroyed or carelessly ignored. While our country was sparsely inhabited, and while enormous areas were left, wherein the unbalancing influence of man had not yet been felt, there was always the consolation of unmeasured abundance upon which to draw. This is true no longer. We of this generation have enjoyed many things which will be denied to the next one. Turning to the examples cited above, enormous areas of chestnut have disappeared. The white pine is attacked by a rust which we think we can control by destroying two other useful growths, albeit at inordinate cost of time and money. No offset has yet been found for the depredations of the borers which are slowly but certainly eradicating the tamaracs in the Sierra. The questions we must face are: What will come next? When shall we recognize its occurrence? How long will it take to discover the cure? Shall we be able to apply the remedy?"

FARMERS' LAMENTATIONS.

Certain native California birds eat growing crops and occasionally cause real damage. Too many farmers, however, attempt to exaggerate depredations. Many letters received regarding such depredations remind us of the annual laments of certain farmers who would make us think that their crops are entirely ruined. As an article we have just read put it, if the wind does not blow all the fruit off the trees, the frost has killed the buds; if the rain does not come at the wrong time and ruin fruit or hay, rodent pests have entirely destroyed certain crops. Several farmers have gone so far as to say that unless relief from the depredations of birds be furnished immediately, they are ready to give up fruit raising, or whatever the crop might be. Those of us who watch not unconcernedly the crop reports, often wonder at the contrast between the farmers' statements of complete loss and the annual enumeration of wonderful crops reaped, and the statement of the carloads sent to market. Not many years ago the grain growers around Tulare Lake maintained that winter grain had been ruined by geese. An investigation showed that some damage was done, but when the crop reports appeared it was shown that a record yield had been obtained from the same ranches from which the complaints had been made.

Birds are but one factor to be considered in the growing of crops, and the wise farmer, instead of becoming discouraged, will simply be led to seek means of preventing damage. Had we more who would devote themselves to solving the problem, a solution would quickly be found, for it is a sad commentary if man's ingenuity can not outwit any bird that flies.

FOR THE VIOLATORS' CONSIDERATION.

Clarence Johnson of Belmont, who had pleaded guilty recently to a charge preferred by Warden Jack Burke that he had shot a doe accompanied by two little fawns, appeared for sentence.

Judge Johnson explained the law to him and outlined the seriousness of this offense and imposed a fine of $200 or sixty days in jail.

After his impressive remarks to the accused youth, Judge Johnson read the following appropriate and timely lines:

The Fawns.

Little children of nature, your mother is dead,
For the hunter has found her his aim;
And long will you lie on your moss-covered bed
And wait for her coming in vain.

The cougar will scream in the dead of the night,
When the wind is a wail in the pine,
Then trembling you'll call for your mother in fright,
You'll call, but no answer is thine.

Ah, long in the hush of your leaf-circled home
You will wait for your mother's return,
While hunger will feed on your delicate flanks,
And thirst will your tender lips burn.

When the moon is as pale as the face of the dead,
And the hoot of the owl is a moan,
The many green paths where so often she led
You will timidly follow alone.

Sweet children of nature, so helpless, so mild,
Little friends of the shadow and glen—
Oh, had I the power to give you what I took,
I'd return you your mother again.

—Guy Fitch in Outdoor Life.

CANADA ENFORCING MIGRATORY BIRDS CONVENTION ACT.

It will be of interest to those concerned in the protection of birds in the United States to learn that the federal legislation for bird protection in Canada is legally sound.

In this connection we call attention to the recent case of The King *versus* Russel C. Clark. The defendant had in his possession a boat, a gun and fourteen Canada geese, at the time he was apprehended by a migratory bird warden. The case was first tried before a local magistrate and dismissed. An appeal from the dismissal was then taken to the Supreme Court of Prince Edward Island.

The court, in its judgment, points out the fact that the Migratory Birds' Convention Act was passed to give effect to a Treaty for the Protection of Migratory Birds which traverse Canada and the United States, the title whereof is not considered vested in any particular part of either country. It was further stated by the court that "the Canada goose is indisputably a migratory bird traversing the continent of America from the frozen north to the Gulf of Mexico and that it is only at certain seasons to be found in any particular part thereof."

The magistrate's order for dismissal was set aside and the appeal allowed with costs. Under this decision Mr. Clark's gun was forfeited and a fine of $10 was imposed in addition to the costs of court.

This case has attracted wide attention among naturalists, sportsmen and all who are interested in the conservation of wild life on the continent, and it is a source of much satisfaction to note this favorable outcome of a test case which assures the legality of Canada's enforcement act.

ADDITIONAL PROTECTION FOR MULE DEER DEMANDED.

With the coming of the automobile and good roads, the large mule deer of northeastern California is being greatly reduced in numbers. During the past season it was estimated that 900 machines containing hunters visited Modoc and Siskiyou counties. The license plates showed that they came from Oregon and Washington as well as from California. Many of these hunters obtained the full limit—two bucks—which shows that a very heavy toll was taken. It is the opinion of many hunters of this region that the mule deer will not be able to withstand such concentrated hunting and a sentiment is growing which favors either the closing of the season on this species for at least three years, thus giving them time to recuperate, or the establishment of a limit of one buck.

DOES THE DOVE SEASON OPEN TOO EARLY?

If we recognize the fundamental conservation law which states that birds and mammals must be protected during the breeding season, there is no doubt but that the dove season for many years opened too early, and many hunters believe that it still opens too early, allowing the killing of birds which are still feeding their young. In this connection the following two letters are of interest:

> "I wish a change could be made here in this district (District 4) on the opening of the dove season. It is too early by one month. Both last season and this I found nests with just hatched birds, August 18 to 20."—Chas. F. Schnack, Escondido, California.
>
> "Yesterday, September 12, I visited a friend who lives near Camanche, or about eight miles from Ione. I went there to have a dove shoot, but in going through my friend's orchard I found nest after nest of young doves not yet good squabs. We counted probably thirty such young broods; then I stuck my gun in the case and quit. This is to suggest that the open season should be one month later."—Frank E. Covey, Stockton, California.

Not only does an early opening of the season endanger the mourning dove, but it often accounts for "soonering" on quail.

TRINITY COUNTY BACKS GAME LAWS.

As a result of the strict enforcement of the law in Trinity County during the earlier part of this season, there have been fewer violations of the game law this year than for several years past. The fine for hunting without a license has been raised to $25; one violator who merely attempted to kill a deer was confined in jail for ten days, while another who was unable to put up $500 bail was compelled to remain in jail for 17 days awaiting his trial. The success of this policy is evident from the small number of deer killed this year.—G. O. Laws, Douglas City, California.

A QUOTATION FROM EARLY CALIFORNIA HISTORY.

From "A Natural and Civil History of California," written by Miguel Venegas, in 1758, we quote an interesting discourse on the brown pelican. Venegas was one of our earliest California explorers. He gives many quaint descriptions containing ideas which are questionable when exposed to present day knowledge.

Venegas, quoting from Father Torquemada a list of birds found about the harbor of "Monte-Ray," continues as follows: "The same author says that in the island of Assumpcion they saw great numbers of a peculiar species of gulls, which, as they are found in several parts of California, it may not be improper to insert here the description of them by Friar Antonio della Assumpcion."

> The gulls live on pilchard and other small fishes; but they are equal to a very large goose in size, their bill a foot in length, and their long legs resemble those of a stork; their beak and feet are like those of a goose. They have a vast craw, which in some hangs down like the leather bottles used in Peru for carrying water; and in it they put their captures to carry them to their young ones. The friendly disposition of these birds is something surprising, for they assist one another, as if they had an unadulterated use of reason. If any one is sick, weak, maimed, or otherwise disabled from going in quest of food, he is plentifully assisted by others, who lay it before him; of this I, myself, was an eye witness in the island of San Roque, where I accidentally found a gull tied with a string, and one of its wings broken; around this maimed bird lay heaps of excellent pilchards, brought thither by its companions; and this I found was a strategem practised by the Indians, to procure themselves a dish of fish; for they lie concealed, while gulls bring these charitable supplies; and when they think that little more is to be expected, they seize upon the contributions.

"Such are the mysterious ways of providence for the support of his creatures."

BLACKBIRDS DAMAGE GRAIN IN IMPERIAL VALLEY.

Mr. F. E. Garlough, an investigator for the United States Department of Agriculture, has recently reported that blackbirds have been very destructive to growing grain in the Calipatria district of the Imperial Valley. Ranchers interviewed reported considerable sums of money expended for ammunition and labor in an attempt to protect their crops. One rancher estimated his expense at four hundred dollars, another at one hundred and thirty-three dollars, and a third at one hundred and seventeen dollars. In addition to a large resident blackbird population, the number is greatly augmented by migrants from the Great Basin, which spend the winter in the valley. The problem is, therefore, likely to continue a serious one.

ALASKA SALMON FISHERY.

On October 26, 1921, a conference was called in Washington by Secretary of Commerce Hoover, to consider the condition of the Alaska salmon industry and the steps to be taken to perpetuate the salmon supply.

The consensus of opinion at the conference was that there has been overfishing of the salmon waters of Alaska; that under the existing law the further depletion of the salmon supply can not be prevented, and that the industry is faced with eventual extinction unless some radical action is taken. It was urged that Congress should at once give full and broad authority to the Secretary of Commerce to regulate fishing in all waters of Alaska over which the United States has jurisdiction, and it is noteworthy that the fishing interests assembled, representing practically 80 per cent of the volume of the salmon canning industry of Alaska, were, with a single exception, unanimous in advocating the bestowal on the Secretary of Commerce of full power and responsibility for upbuilding and preserving the salmon supply.

ALASKA SALMON INVESTIGATIONS.

Dr. Charles H. Gilbert and Field Assistant Henry O'Malley returned from an extensive trip to Alaska, which was devoted to a study of the runs of salmon in the southeastern and central districts. Special attention was given to the salmon of Kodiak Island, where a rack had been constructed in Karluk River early in the season and the counting of red salmon ascending the stream was being carried on. It is reported that up to September 17 the total escapement of red salmon up the river was 1,322,000. Dr. Gilbert advises that the investigations in the Karluk region were most interesting and profitable. Every spawning stream tributary to Karluk Lake was examined, and upward of 1,000,000 red salmon were observed on the very limited spawning grounds of that district. The escapement for spawning as related to the commercial catch, a subject which the bureau has under consideration at Karluk and Litnik in Alaska, as well as at Quinault Lake and Baker Lake in Washington, is receiving merited attention from the fishing interests. It is the purpose to continue the work in these fields and to extend the experiments to other favorable streams.—Fisheries Service Bull. No. 77, p. 3.

OIL POLLUTION.

The pollution of waters by oil from refineries and its consequent destruction of fish and bird life, has attracted attention the world over. At a recent conference in Washington, over pending legislation in Congress, the side of the oil interests was emphasized by oil men present. According to their statement, the bills now pending in Congress are discriminatory in that they single out oil interests for special legislation. In reality, oil is but one form of water pollution now affecting the fisheries. Fortunately a splendid attitude of cooperation on the part of the oil interests was manifested.

JUSTICE TO GAME WARDENS.

The work of the game warden, when well performed, should earn for him not merely the small recognition of moderate pay, but in addition to this the honor due to faithful service, the hearty cooperation of those who derive the greatest benefit from his strenuous, often hazardous toil. A complete list of the game wardens killed and wounded in the performance of their duties would bring to the public greater realization of the dangerous nature of the daily routine of a class of men too often reviled instead of rewarded—the yearly honor roll of those who have made the supreme sacrifice passing into oblivion, while the negligence of the few appears to be blazoned forever by detractors desiring to discredit the game warden system. The great injustice of this is evident.

If every state in the Union could boast perfect laws for the proper protection of game and fish—the federal protective law equally perfect—these restrictions would be nothing more than the proverbial "dead letter" on the statute books without means of enforcement. Laws are inoperative if not enforced, and this applies particularly to those legislative enactments which are not fully in accord with the wishes of nearly all concerned. Game laws are still regarded in the light of so-called class legislation by so many men failing to grasp or admit the beneficent purpose that the need of good wardens, faithful and fearless enough to risk their lives in devotion to duty, must be admitted by all unprejudiced observers. As brave public servants they deserve and should receive support.

In few other, if any, branches of state employment does the expense of officials engaged in the work fall almost entirely upon the class supposed to benefit mainly through enforcement of a law. The gun license system has become so general throughout the entire nation that the proceeds in each state serve to pay the game wardens, and in some instances a portion of the revenue derived is even diverted to other interests, where the powers that be ignore the purpose of the fund—the evident if not always clearly specified principle governing its expenditure. To this extent the sportsmen of the land are doing their full share, but the moral obligation of active aid in the cause of conservation should never be ignored. Sportsmanship stands upon a broader basis than passive approval of good game laws and the work of good game wardens.

The direct, pecuniary benefit derived from strict enforcement of the game laws naturally falls to the farmer. The sportsman has his pleasure, for which he pays liberally in the expense incurred, while the tiller of the soil—the fields where Bob White has happy habitat—finds reward in relief from insect pests injurious to growing crops, with the clear whistle of the birds to lighten his own day labors. The clear-sighted granger should realize and appreciate alike the work of the wardens and the fees of the license-paying sportsmen, which combine to make the game laws effective, thus—with the farmer's hearty cooperation—forming a sort of invincible triumvirate guarding against annihilation of game birds in general and that universal favorite, the quail, in particular.—*American Field*, November 26, 1921, page 1.

GOVERNMENT HUNTERS KILL MANY PREDATORY ANIMALS.

Since 1915, when Uncle Sam turned hunter of wild animals that roam the western ranges and prey on the farmers' live stock, he has accumulated a game bag the like of which was never before witnessed in history, according to reports to the Biological Survey, United States Department of Agriculture, just made public.

By trap and gun the government hunters have killed a total of 156,150 predatory wild animals. That period represents the time of government activity in that kind of work.

During the fiscal year 1921 figures show the total number of predatory animals killed was 27,637, classified as follows: 89 bears, 2468 bobcats and lynxes, 24,258 coyotes, 128 mountain lions, and 594 wolves. The average destruction by these animals is estimated to be, for each wolf and mountain lion, about $1,000 worth of live stock; each coyote and bobcat, $50 worth; and each stock-killing bear, $500 worth.

SALE OF GOVERNMENT FURS.

A public auction sale of 10,087 dressed, dyed, and machined Alaska fur-seal skins and 1125 blue and 14 white fox skins from the Pribilof Islands was held at St. Louis, September 28, 1921, by the Fouke Fur Company, the department's selling agents. A considerable number of low grade skins included in the offering of fur-seal pelts brought the average price per skin down to $32.99, the total gross price bid being $333,924. Prices obtained were approximately 7½ per cent lower than the next preceding sale in May, 1921. The blue foxes sold averaged $96.83 per skin, an average advance of about 20 per cent over the prices received at the preceding sale in February, 1921. The total amount bid for fox skins was $109,398—Fisheries Service Bull. No. 7, p. 4.

GAME SHIPMENTS MUST BE LABELED.

The Bureau of Biological Survey, United States Department of Agriculture, calls attention to the fact that under federal law all packages in which wild ducks, geese, and other migratory game birds are transported, must have the name of the shipper and of the consignee and an accurate statement of the numbers and kinds of birds contained therein clearly and conspicuously marked on the outside thereof. Sportsmen shipping game birds without proper markings are liable to prosecution in the federal court and the birds to seizure and condemnation.

THE FRESH WATER MUSSEL A PARASITE ON FISH.

A recent publication of the United States Bureau of Fisheries (Document 893, pp. 1–181), details the life history and habits of the fresh water mussels of the Mississippi and Great Lakes drainages. That the work is timely is evident when it is known that the continual demand for these mussels for food and for the making of pearl buttons has brought about a need for careful conservation. A knowledge of the life history is the first need, when planning suitable protective legislation.

Outstanding in the life history of the fresh water mussels is the fact that in the larval stage they are parasitic on fish. The larval form, designated as glochidium, when completely developed and ready to emerge from the egg membrane, is a soft mass of flesh with neither gills nor foot, but with a thin shell composed of two parts like the bowls of tiny spoons, hinged together at the top. The number of glochidia born in the brood pouches of fully grown female mussels varies in the different species, from 75,000 to 3,000,000. If the glochidium matures its continued development is dependent upon its coming in contact with the gills or fins of a suitable fish host, and attaching to them. If it fails to make this attachment it dies within a few days' time. This is apparently true of all but two of the fresh water mussels. The larval mussel attaches itself by firmly clamping its valves to the tissues of the host. A certain portion of the tissue of the fish thus becomes inclosed and this quickly disintegrates and is consumed as food. The attachment causes tissues of the host to grow rapidly until the larval mussel is completely enclosed within a protective covering known as a cyst. After the period of incystment the mussel has attained a sufficient development to begin an independent life and to care for itself. Duration of the parasitic period may last from ten days to two or three months.

Twenty-six different species of fish are known to act as hosts to the developing mussels. Among them are such well known fish as the bullhead, yellow cat, small mouth and large mouth bass, yellow perch, crappie and striped bass.

The fact that fresh water mussels are dependent upon fish for existence during part of their lives emphasizes the fact that the conservation of the fishes is just as important to the preservation of the fresh water mussel resources as is the propagation and protection of the mussels themselves. "The disappearance or radical diminution in number of certain species of fish would result in the complete or virtual disappearance of corresponding species of mussels. On the other hand, as the growth of mussels in more or less dense beds produces conditions which are favorable to the growth of fish food—and observations do so indicate—then the disappearance of the fresh water mussels would result in the diminution of the food supply for fishes and the conservation of mussels is important for the preservation of our resources in fish."

LIMIT ON HUNTING LICENSES ADVOCATED TO CONSERVE BIG GAME.

During the hunting season last year more than 5,000,000 persons, estimates the Biological Survey of the United States Department of Agriculture, went out with guns into the woods and fields of America. Their going emphasizes the growing need of more adequate and uniform laws to conserve and protect the country's dwindling game supply.

"It has been the practice in many states," the department says, "to issue hunting licenses for the open season to all applicants, with too little regard for the available game supply of any particular area. The hunters may far outnumber the animals hunted within a given section, and under such conditions the extinction of big game especially is inevitable.

"The Department of Agriculture advocates a limited license plan for big game, based on annual estimates of game conditions in each district. This means that the number of big game licenses issued for a given area in one season would depend upon the number of game animals which it has been determined in advance can be spared. Proper administration of this sort should conserve game in the greatest numbers consistent with the reasonable demands for local grazing and other interests and obviate the necessity for establishing perennial closed seasons, except on areas being restocked."

DEER CONDITIONS IN THE TRINITY REFUGE.

For the past two years I have been filling the position of fire observer in the lookout on Bally Mountain, and being greatly interested in wild animals and their life history, I undertook a study of deer and their habits. Bally Mountain is situated practically in the center of Fish and Game District 1D. The Indian name for this mountain is "Lolcha Bola," meaning in English "Ghost Mountain." The Indians never hunted game on this mountain, as they were superstitious and believed in ghosts.

The south slope of the mountain is very steep and rough and is covered with various types of brush on which deer feed. The north and east slopes are covered with heavy timber and the does and smaller deer seem to stay on this side, going over to the south side mornings and evenings to feed.

I salted the deer both seasons near the station. The first two months of the season, July and August, does, bucks and fawns could be seen together at the salt logs in considerable numbers. In September and October I noticed a decrease in the number of bucks going to the salt logs, but the does and fawns continued going until I left, October 26.

I noticed a number of deer of different color. A cream colored and a red buck seemed to travel together. I saw them every few days in 1920 and 1921. I also observed a buck with a white head and neck, and one with a split ear hanging down on the side of his head. The does and smaller deer visited the salt logs more regularly than the bucks. A doe that had three fawns stayed near the lookout all during the summer of 1921. Many of the deer became very tame and hardly ever were frightened away. They were often near the Aladade map table and flag station, sometimes within fifty feet while I worked on the map. However, good pictures were hard to obtain on account of the dense brush.

My record of the deer seen in 1920 was 3276. In 1921, 3673 were observed, making an increase of 397 for 1921. Doubtless the same animals were counted many times.—Elsie R. Luckie, Hayfork, California.

IS THE DOVE BAG LIMIT TOO LARGE?

Are bag limits too large? They are. Fifteen doves are more than one man needs in one day. Most sportsmen would be, and all hunters should be satisfied with a bag limit of eight or ten dove, quail, or duck. If the bag limit on dove is not reduced and hunters persist in shooting them when they are coming to water or potting them while they are sitting on telephone wires and in trees, we will not have long to wait until the curtain is drawn on dove hunting.

Nature has been kind to the doves this year in southern California. Heretofore dove weed grew only in small patches along bean fields and dry washes. This year whole fields and even ranches are literally covered with the tidbit of the doves. This fact has helped to keep the birds more scattered and harder to hunt, yet there were over a thousand limits reported in Los Angeles the opening day of the season.

While hunting doves the second day of the season I saw three hunters shoot at a bird in succession, each missing it clean. The dove flew down the canyon and passed me at about forty yards distance. I fired once and missed. Instead of flying on out of range the dove banked sharply and landed right in front of me and began to eat. I noticed then that the dove was almost pure white. There were no spots on his back or neck. His wings and back were just a little darker than the breast. I walked closer to him hoping to get a better idea of his size and color but he flew away with that peculiar whistle of a mourning dove. I will add that the three hunters shot at him again as he darted over their heads; with the same good luck he flew on unscathed.—Edgar K. Lipking, Sawtelle, California.

FACTS OF CURRENT INTEREST.

The gray squirrel appears to be getting scarce in many sections, especially in southern California, and there is increasing demand for additional protection.

* * *

Computation of the salmon catch from January 1 to September 30, 1920, shows a total of 10,777,056 pounds. The catch for the same period in 1921 totaled 7,582,738 pounds, a decrease of 3,194,318 pounds.

* * *

That the mountain lion is still found in numbers in certain places in California is evidenced by the fact that J. G. Moore of Los Olivos, Santa Barbara County, recently applied for bounty on eleven lions taken between October 9 and November 26, 1921, in the Santa Barbara National Forest. The bounty will total $300.

* * *

A spoonbill duck apparently banded in Manitoba by the Mercantile Company was recently killed by a hunter on the Salton Sea in Imperial County, California.

* * *

Judging by reports from forest officers, the coyote continues to be a serious pest in many sections. This predatory animal attacks sheep and other domestic animals as well as deer.

* * *

The band-tailed pigeon appears to be on the increase, for there are many reports to the effect that the birds are breeding in considerable numbers in many sections of the state.

* * *

The open season on waterfowl has furnished good sport in many sections, but can not be considered extraordinary.

* * *

Game law violators have received heavy fines from the judges of the state, minimum fines being $25 and maximum $250. The attitude of the judges is doing much to prevent violations and make enforcement easy.

HATCHERY NOTES.

W. H. Shebley, Editor.

TROUT DISTRIBUTION, 1921.

The distribution season at the state hatcheries was closed on November 18, when the last fry from Mount Whitney Hatchery were delivered to the Bishop Chamber of Commerce for the streams of Inyo and Mono counties situated north of Bishop.

The total output of trout fry from the different hatcheries for the season of 1921 was approximately 24,500,000. At this date all reports are not in.

The output from the different hatcheries was as follows:

Mount Shasta	12,500,000
Fall Creek	650,000
Mount Whitney	2,300,000
Fort Seward	1,200,000
Lake Tahoe	1,000,000
Mount Tallac	900,000
Ukiah	550,000
Snow Mountain	160,000
Brookdale	900,000
Domingo Springs	550,000
Clear Creek	350,000
Feather River	800,000
North Creek	1,000,000
Bear Lake	1,200,000
Wawona	400,000
Kaweah	400,000

With the exception of two or three minor cases where a few thousand were affected, all of the fry were reared without any epidemics. Prompt action and efficacious treatments in these instances soon put them in good condition. Especial care was used in planting the fry to see that they were planted in suitable waters and given a wide distribution.

The demand for trout fry was greater this season than at any time in the history of the state, due to the increasing number of anglers and the easy access to the streams and lakes, that has been brought about by the construction of new highways and the increasing use of automobiles. Nearly every stream is fished to its limit. A shorter fishing season will have to be instituted in this state if the people are to continue to enjoy good fishing. The long open season does not give the fry planted a chance to grow before they are caught out.

In every section of the state there has been a demand for more trout fry by resort keepers, chambers of commerce, county boards of supervisors and others who are boosting their different localities. This demand on our hatcheries has been greater than finances and equipment can furnish. If the people insist on increasing the supply of trout fry to supply the great demand made on the waters of this state they must ask the next legislature to increase the angling license or provide other means of revenue to increase the output of the state hatcheries.

Improvements were made at Mount Shasta Hatchery, the Klamath River Egg Collecting stations, Bear Valley Hatchery and the Fort Seward Hatchery. An experimental hatchery was operated near Johnsville, Plumas County, to determine whether the water was suitable for hatchery purposes. The experiments were successful and whenever the funds are available a permanent hatchery will be erected on a site leased from the Plumas-Eureka Mining Company.

A new egg collecting station was built on the South Fork of Eel River, near Branscomb, Mendocino County, in an effort to collect more steelhead trout eggs and to determine whether chinook salmon eggs can be collected in sufficient numbers to furnish the Fort Seward Hatchery with eggs enough to supply fry to maintain the salmon run in the Eel River. Traps were placed in the South Fork of the Eel River, Dutch Charlie Creek and Kinney Creek. Cabins were built for the help at South Fork of Eel River stations and at Kinney Creek. Twenty-five hundred feet of ditch and flume were constructed to furnish the station with an adequate supply of water.

The upper reaches of the South Fork of Eel River near Branscomb is the region in which a great many of the best spawning areas of the river are found. The salmon spawn late in this section, during December, when weather conditions are favorable. This fall the unusually dry period in that section has not been favorable for the movements of the salmon up stream and it may not be possible to determine the number and length of time that the salmon run in the headwaters of the South Fork of Eel River. Plans are being made to collect the steelhead trout in these traps this coming spring.

SALMON DISTRIBUTION, 1921.

During the season of 1921 three millions of salmon fry were reared in the ponds at Mount Shasta Hatchery for distribution in the Sacramento River and two millions of salmon fry were reared in the ponds at Fall Creek Station for distribution in the Klamath River.

The work of collecting salmon eggs at Klamath Station on the Klamath River was finished on November 25. The season was favorable for the salmon to ascend the river and a total of 19,500,000 chinook salmon eggs were collected. This was the largest number of eggs collected during any season since the establishment of the station in 1910. There was still a number of salmon running at the time the station was closed that would have added several million more eggs to the season's take, but limited funds necessitated the stopping of operations in preparation for the collection of the rainbow trout eggs, as the spawning trout were ascending the river to enter the tributary streams.

During the fall and winter of 1920–1921 experiments were made in hatching salmon eggs in a small experimental station in Crane Valley, Madera County, to determine whether the site was suitable for the hatching and rearing of salmon eggs, should it be decided to operate an egg collecting station and hatchery below Power House No. 4 of the San Joaquin Light and Power Company's dam on the San Joaquin River. The San Joaquin Light and Power Company have erected a dam across the San Joaquin River near Aubery over which it is impracticable to construct a fishway. They also divert all the water from the river through a 17,000-foot tunnel, thus drying up during the summer and fall about fourteen miles of the bed of the San Joaquin River, between the dam and Power House No. 4. This prevents the salmon from passing up the river to their former breeding grounds and if the salmon in the San Joaquin River are not to be exterminated a rack and traps must be installed in the river near Friants, so that the eggs may be collected and hatched and the resulting fry released in the San Joaquin River below the dam. Our experiments proved that the location in Crane Valley was not a suitable place for a salmon hatchery.

It is proposed to rack the river near Friants and pump the water from the river for a hatchery supply next season. The expense of building the racks and traps, hatchery, living quarters for the help and equipping the same must be borne by the San Joaquin Light and Power Company, as the law provides that wherever a dam is built over which it is impracticable to construct a fishway for the free passageway of fish, the company or individual owning the same must erect and equip a suitable hatchery and egg collecting station free of charge to the state. An amendment to this law should be made at the next session of the legislature compelling the owners or occupants of such dams to not only construct and equip the hatcheries but to furnish the necessary funds to the Fish and Game Commission to operate the same, as they destroy the natural runs of fish and give the people nothing in return for the fishing interests that they destroy. The sum for operating such stations could be allocated among the different owners of the dams, if there were more than one owner or occupant of dams on any river or stream.

LIFE HISTORY NOTES.

THE OPOSSUM AT EL MONTE, LOS ANGELES COUNTY.

About a month ago, while engaged in flood control work on the Rio Hondo, north of El Monte, Los Angeles County, I noticed some boys carrying a box trap down the river. On stopping them I found they had trapped an opossum. They told me that they had seen another, evidently its mate, in the willows along the river. I could not find out how long the opossum had been in that locality or if more than two had been seen.

Judging from the reports on opossum in the last number of CALIFORNIA FISH AND GAME, the "midnight frolic" of the Old South will eventually come to southern California.—Edgar K. Lipking, Sawtelle, California.

UNIQUE EXPERIENCE WITH MOUNTAIN LION.

A rather unique experience with a mountain lion is told by L. S. Davey, of Usona, Mariposa County, California. Mr. Davey says:

> "It was in the month of April, 1898. I had been plowing in my orchard, and had gone to the house for dinner. After dinner I took my rifle and walked about three hundred yards north of the house to a field of barley to kill some ground squirrels, when all at once I heard a small pig begin to squeal and saw the sows rallying together about three hundred yards farther on. As the pig continued to squeal for several seconds, I knew that something was killing it, so I ran across the creek to where the hogs were, and found the sows around the foot of an oak tree, very angry and worked up.
>
> "When I first came up to the tree, the sows showed fight, but moved on up the hill as the pig had stopped squealing. I began looking for signs and found blood scattered on the oak leaves, and while making an examination I noticed blood dropping from the tree. Looking up I saw a mountain lion holding a pig in his mouth and still watching the sows. I raised my rifle and fired, the bullet striking him in the region of the heart. He jumped from the tree, ran about thirty yards, and fell dead."

A somewhat similar incident happened during the past summer when Louis Austin of Grizzly Flat killed a lion which had apparently been treed by sows after the lion had killed a small pig. Frank Barrett of Kingsley, California, vouches for the incident, having arrived on the scene shortly after the lion had been killed.—H. C. Bryant, Berkeley, California.

CAPTURE OF OCEAN SUNFISH OFF CATALINA ISLAND.

In the Zoological Society Bulletin, November, 1920, the capture off Santa Catalina Island, California, of an ocean sunfish (*Mola mola*), is recorded by Mr. Van Campen. An effort was made to harpoon the *Mola* and bring it to Avalon alive, but after a hard struggle it was necessary to shoot the fish before it could be towed in. After landing, a large crowd viewed the fish with much interest. The weight of the sunfish was estimated as about 2000 pounds, the actual measurements being ten feet and eleven inches from tip of snout to end of caudal and ten feet and ten inches in depth from tip of dorsal to tip of anal.

GRAY SQUIRREL DISEASE SPREADING.

The disease (scabies) attacking gray squirrels, described in the April number (p. 128) of CALIFORNIA FISH AND GAME, appears to be spreading throughout northern California, as is evidenced by the following reports of forest officers for 1920:

> "Tree squirrels are getting so scarce in the Trinity section of the Shasta National Forest that only one or two are seen on a day's ride. A closed season of five years is recommended for this animal. Some of these animals are affected with some disease. Of four I saw last season, all had it. It seems to be a kind of scab and takes away all their strength, as they are unable to climb or make any time on the ground."—James H. Stone, Sisson, California.
>
> "In the Squaw Creek district of the Shasta National Forest on lower Pit River, the gray squirrel was very abundant up to 1919, when for some reason he almost disappeared. This disappearance might be due to migration or some disease that broke out among them. The latter is thought to be the case."—J. R. Hall, Sisson, California.
>
> "The gray squirrel is generally considered quite valuable as a game animal and is reported as quite numerous in some sections of the Klamath National Forest. It is reported that a disease breaks out every few years among the squirrels on the lower Klamath River, which reduces their number considerably. In instances observed, small red spots appear on the skin; the hair comes out in large patches giving the appearance of mange. Specimens observed have been very emaciated."—B. J. Shannon, Yreka, California.

CONSERVATION IN OTHER STATES.

NEW HUNTING ACCIDENT LAW IN PENNSYLVANIA.

The Pennsylvania legislature has recently passed a law making it a misdemeanor to shoot at, either injuring or killing persons in mistake for game, the penalty being from one to five years imprisonment, with a fine of from $100 to $500. The fine goes to the state unless the shot results in an injury, when the fine goes to the person injured; or, if death results the fine goes to the relatives of the deceased. Every state should have a law of this character which offers needed relief for the not uncommon occurrence of injuries or deaths resulting from the carelessness of sportsmen.—R. P. Holland, *Field and Stream*, 26, p. 501.

PUBLIC SHOOTING GROUNDS FOR OHIO.

Ohio is one of the first states to provide for public shooting grounds by legislation. The legislature of that state recently passed a public shooting ground and game refuge bill which gives the Ohio Bureau of Fish and Game almost unlimited authority in establishing public shooting grounds throughout the state. Ohio will stock her refuges and public shooting grounds with quail, wild turkey and Virginia deer.

OREGON NOTES.

Oregon has purchased the Simpson Game Farm and the Eugene Game Farm and these are now being operated with money furnished by hunting licenses.

The bob-white is on the increase in Oregon, according to the last biennial report of the Oregon Fish and Game Commission.

Oregon demands that the state laws should be made to conform with federal legislation regarding waterfowl. Oregon appears to be one of the last states to make this adjustment.

This state is trying out a scheme of holding steelhead trout in breeding farms at the hatcheries until they are one year old.

HUNGARIAN PARTRIDGE IN WASHINGTON.

A remarkable measure of success has been secured in planting the Hungarian partridge in Spokane County, Washington, and surrounding territory. About sixteen years ago an unsuccessful attempt was made to plant the Hungarian partridge in this district, but the effort made a few years later has proven such a success that sportsmen in Vancouver have also planted the birds with the same satisfactory results. It has even been suggested that the bag limit, which is now five birds per day per gun, may be safely increased within the next few years. The Hungarian seems to do better in this district than in its native habitat, and it is found that the species gives evidence of attaining a larger size than in Hungary. The Hungarian partridge is the native gray-legged partridge of all Europe and the British Isles, and it is significant that in Washington the birds appear to have thriven in the humid coast section as well as in the dry eastern part of the state.—R. P. Holland, *Field and Stream*, 26, p. 295.

NONDRAINAGE OF IOWA LAKES ADVOCATED.

As indicating deep public interest in the subject, it is interesting to notice that in the report of the Iowa State Highway Commission (1920), upon "Iowa Lakes and Lake Beds," retention and improvement of the lakes is recommended in nine-tenths of the cases, thereby adopting a policy of conservation in the interest of the rights of the entire public, as opposed to the policy of the drainage advocates. After a thorough investigation of the damage to crops which it had been claimed was a result of the wild birds which congregate in the vicinity of these lakes, the Commission reached the conclusion that in the relations of lakes, bird pests, and the public, it would be highly preferable that direct control measures be applied to the injurious species rather than that the lakes be drained, for the latter are not only of great value as recreation places but also are the center of abundance of numerous species of wild birds, including valuable game birds entirely dependent upon the presence of the lakes. W. L. McAtee (*Auk* 37, pp. 620–621) points out, however, that in insisting upon the raising of the water level, in order to discourage dense growths of water lilies, of cattails, rushes, and of marsh as a whole, the report errs in that the marsh is absolutely necessary as a breeding home for practically all the birds which are attracted by the lakes. While saving lakes from drainage is a conservation measure, wild life will suffer practically as much from elimination of marshes as it would from drainage.

WISCONSIN TO RECORD ANNUAL DEER KILL.

An effort is being made this year in Wisconsin to obtain a comprehensive report of the killing of deer within that state. By this report, which will be made up from returns sent in by the hunters throughout the state, it is expected that statistics will be available as to the number of bucks killed, their weight, in what county the most were killed, what days and what time of day most were killed. Such statistics will not only be of great interest to the hunters of Wisconsin but will also be very important as a basis for future legislation.

BIRD PROTECTION IN FLORIDA.

The Florida legislature has again had the subject of conservation of the state's resources presented strongly to it by able advocates, and again has this honorable body turned a deaf ear to those who would have the state appoint game wardens to enforce the now unenforced laws for the protection of wild birds and animals. Florida now is practically the only state in which this unfortunate situation exists. However, it is expected that the matter will be taken up again with increased interest and vigor at the next session of the Florida legislature.—*Bird Lore*, 23 p. 229.

NEW YORK LEGISLATION.

From the one hundred and thirty-five salaried game wardens in the state of New York the force is now reduced to ninety, by the amendments to the game laws of that state which were passed by the last legislature. Since these men have been trained for years for their duties, the change must be regarded as decidedly detrimental to the interests of conservation in the state of New York.

Furthermore, Governor Miller has released George D. Pratt from the position of State Conservation Commissioner. This change is purely political and was not made because of any expressed dissatisfaction regarding Mr. Pratt's administration.

KILLING OF ANTELOPE AND MOOSE IN WYOMING PREVENTED.

At the last session of the Wyoming legislature a bill was passed granting authority to the Game Commission to issue permits, if they thought wise, for the killing of 100 buck antelope and 100 bull moose within the borders of the state. Both of these animals have for some time been absolutely protected. The antelope especially is becoming a very rare animal, in fact, entirely exterminated over large areas of its western range.

The home office of the National Association of Audubon Societies, upon being informed of the pending disaster, instituted a vigorous campaign of protest, as a result of which the permission to issue permits to shoot 100 antelope was withdrawn and the number of bull moose permits reduced to fifty.

FOREST SERVICE COOPERATION.

LARGE ANNUAL KILL OF DEER IN THE SANTA BARBARA NATIONAL FOREST.

Following is a list of the deer killed on or near the Santa Barbara National Forest during the season of 1920:

Santa Barbara County	119
San Luis Obispo County (Kern County included)	65
Ventura County (Los Angeles County included)	164
Monterey County	513
Total	861

There was a total of 978 reported last year, which would tend to indicate that hunting was not being carried on as formerly, or else that deer are becoming scarcer. However, from our observations the woods were full of hunters and it is known that more deer were killed than we were able to get a record of. This, along with information obtained from forest users, indicates that the deer are just about holding their own against the hunters and lions, with a probable increase in some localities.—Thomas W. Sloan, Santa Barbara, California.

COYOTE BOUNTIES IN TRINITY COUNTY.

The report of bounties paid out for the year 1920 by the county treasury shows that $1,323 was paid on coyotes. Of this amount $1,080 was paid for coyotes taken during the winter months when trappers were taking them for fur, and $243 was paid during the summer months, showing that one-fifth of the coyotes were killed during the summer for the reason that there was no fur value so far as dollars and cents go.—Alva Tracy, Knob, Trinity County, California.

DEER PROTECTION IN TRINITY NATIONAL FOREST.

A buck is lawful game at the age of two years. However, at that age he is usually still running with the doe and is not acquainted with the tricks and ways of dodging the hunter practiced by his older brother. A common saying among the stockmen is "Anybody can kill a forked-horn but it takes a hunter to get an old smarty." With so many hunters on the ground during the entire open season the "old smarty" is becoming very scarce and if this practice continues a few more years to the extent that it has in the past he will become extinct and the young bucks—the easy prey of the hunter—will be killed off as fast as they become lawful game. This would leave few, if any, besides the yearling or "spike-buck" to propagate the species. The value of a yearling buck can well be compared with a yearling in domestic stock. Under such conditions there would be a much lower percentage of fawns in a very short time, which would necessitate a close season for a period of years to allow the deer to stock up to standard. This would also show that in the past the game protection had been under poor management.

One suggestion I have to offer is a shorter open season, although a far better one is a game refuge covering North and South Yola Bola Mountains and the headwaters of the South Fork of Beegum Creek, South Fork of Cottonwood and Cold Fork creeks. This is a natural breeding and feeding ground.—Alva Tracy, Knob, Trinity County, California.

NEW GAME REFUGE PROPOSED FOR SANTA BARBARA NATIONAL FOREST.

A game refuge is recommended in the Santa Ynez district for a double purpose, namely:

First, to provide for an area into which a number of people go and in which hunting is forbidden, and also into which the game drift from the higher areas. It is felt that a game sanctuary is needed to better protect and perpetuate especially the deer that come down for water into the region covered by the proposed refuge.

Second, within the area covered by the boundaries of the proposed game refuge is what is known as Gibraltar Dam, in the Santa Ynez River, which impounds a large body of water with a surface of about 280 acres and from which the city of Santa Barbara derives its water supply, and it is very much desired by the city of Santa Barbara that everything possible be done to protect the domestic water supply from possible sources of contamination.—Thomas W. Sloan, Santa Barbara, California.

DEER PROTECTION VERSUS DOMESTIC STOCK ON THE CALIFORNIA NATIONAL FOREST.

While the number of deer now on the forest seem to be well provided with feed without materially reducing the capacity for sheep and cattle, it is obvious that with complete protection such as they must eventually get, deer could be increased to the entire capacity of the winter deer range which would include a large amount of summer cattle and sheep range.

Our estimated winter capacity is 635 cattle which would probably be equivalent to 6000 deer. Our estimated summer capacity is 7600 cattle and 50,000 sheep and in addition to this it is estimated that 40,000 deer are getting year-long feed on the forest. Much of the range now used for early grazing is suitable for winter deer range and if no paid permits were issued it is probable that the forest would provide year-long range for 175,000 deer, and in addition the capacity of the private land in cattle and sheep.

The maximum receipts which we can expect from grazing is less than $15,000. If cattle and sheep were excluded from the forest it would work a hardship on 175 permittees who would be forced to go elsewhere for summer feed. On the other hand a comparatively small area of the country at large comprising the area best suited to the purpose would be devoted to the perpetuation through use of a valuable, natural, public resource. No restrictions other than those imposed by the state game laws would be placed on the taking by the public of the mature bucks, of which from twenty-five to thirty thousand could be killed annually without danger to the breeding stock.

Roads and trails would be improved and the local communities would be benefited by the money spent by thousands of visitors for horse hire, guides and supplies. We have a record of 1000 deer killed during the past season (1920) and it is very probable that as many more were killed and not reported. These 2000 deer should average 75 pounds of dressed meat each which, compared to beef prices, should be worth 30 cents per pound, $22.50 per deer, 2000 deer $45,000. Add to this the healthful exercise, pleasure and self-satisfaction of over a thousand successful hunters, multiply all by ten and you gain an idea of the value and possibilities of the suggestion.—B. H. Mace, Willows, California.

ELK INCREASE IN KLAMATH NATIONAL FOREST.

There is a herd of five elk on Scott River in the Klamath National Forest and one has occasionally been seen on Salmon River watershed. These are unquestionably the original herd of three that were liberated in this vicinity about five years ago. They are apparently in good shape and doing well. This sufficiently demonstrates that this region is adapted to elk. The habits, range and food are practically the same as those of the black-tailed deer. —B. J. Shannon, Yreka, California.

SAGEY TASTE MAY BE REMOVED FROM SAGE HENS.

Sage hen, or sage grouse, as it is sometimes called, is the leading game bird of the Modoc National Forest. This grouse is very plentiful and a splendid game bird. The season should open fifteen to thirty days earlier and close that much sooner since it is impossible to distinguish between young and old birds on the wing and the old birds are often thrown away by the hunters. Sportsmen claim that the old birds are tough and sagey in taste, although personally I believe the sage taste permeates the meat after the bird is killed. I have found that if the craw is removed immediately after killing and the meat soaked for a few hours in cold salt water before being cooked that there is no appreciable difference between young and old birds. Supervisor Durbin also a few years ago ate sage hen almost daily for a couple of weeks handled in this manner and states that practically no sage taste was noticeable. Nevertheless this prejudice exists in the minds of at least ninety per cent of sage hen hunters, including many of our own forest officers.—Wm. S. Brown, Alturas, California.

BAND-TAILED PIGEONS ABUNDANT IN PLUMAS NATIONAL FOREST.

Wild pigeons are found on the southern half of the Plumas National Forest. They nest both on the ground and in trees or bushes and lay from one to two eggs. I found a nest during the middle of September with a pigeon in it about half grown. This nest was built in a bunch of alders about eight feet from the ground and consisted of a few small sticks. They feed on berries, pine nuts and acorns. They can usually be found near mineral springs, especially soda and sulphur springs. I noticed an unusually large number of wild pigeons during the past season; a flock near the soda springs at Keddie in December numbered nearly a thousand.—Henry A. Kloppenburg, Quincy, California.

REPORTS.

STATEMENT OF EXPENDITURES.

Period July 1, 1921, to September 30, 1921.

Administration:		
Commissioners	$187 46	
Executive offices	6,384 05	
Printing	141 25	
Research and publicity	1,333 43	
Accident and death claims	11 28	
		$8,057 47
Commercial fish culture and conservation:		
Superintendence	$4,550 50	
Inspection and patrol	7,982 71	
Research	7,891 00	
State laboratory construction	14,034 29	
Statistics	2,104 38	
Market fishing license commissions	110 00	
Propagation and distribution of salmon	10,411 12	
		$47,084 00
Sporting fish culture and conservation:		
Superintendence	$3,947 25	
Printing	235 90	
Prosecutions and allowances (fish cases)	1,840 95	
Angling license commissions	5,104 40	
Fish exhibits	4,418 25	
General patrol, pro rata share—		
San Francisco District (40 per cent)	10,764 26	
Los Angeles District (40 per cent)	3,952 74	
Sacramento District (40 per cent)	8,104 41	
Propagation and distribution of trout	53,452 45	
		$91,820 61
Game conservation:		
Printing	$287 70	
Prosecutions and allowances (game cases)	380 72	
Hunting license commissions	7,006 70	
Mountain lion hunting (and bounties)	1,692 80	
General patrol, pro rata share—		
San Francisco District (60 per cent)	16,646 39	
Los Angeles District (60 per cent)	5,931 13	
Sacramento District (60 per cent)	12,116 31	
		$44,061 75
Tahoe camping ground		633 05
Grand total		$191,656 88

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1921.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Total	Mexican, brought into California
Albacore[†]											10,977,325	6,753	3,767,159	11,751,228	2,199
Anchovies							82,639		980,177		950			1,064,117	
Barracuda										88,758	684,126	2,006	105,084	879,974	83,969
Bluefish							86	1,981	17,665					19,732	
Boccaccio							13,104	14,601	95,265	282				123,252	
Bonito								280	16	6,051	62,147	395	13,351	82,240	2,800
Carp				103	792	10,212								11,107	
Catfish		2,283			291									2,574	
Chilipepper							1,370	6,834	650					8,854	
Cultus Cod	3,382	13,241	669				136,055	5,172	16,541					175,060	
Dolphin															
Eels															
Flounders				72		556	77,549	7,250	299	1,550	1,408			89,011	
Grayfish						683	25,930				2,602		26,360	55,575	
Greenfish															
Hake							29,495	1,425						30,920	
Halibut	17,450	46,535	2,011				50,331	374	5,075	39,378	96,131	13,177	282,578	553,040	560,588
Hardhead															
Herring															
Kingfish							5,466	5,942	1,085	1,100	7,202		315	21,110	50
Mackerel								298	191,309	10,518	428,097	8,032	60,279	728,533	1,194
Marlin															
Mullet													2,602	2,602	
Perch	867	279,071	615				8,530		3,928	20	17,908	450	2,810	35,128	
Pike					18	122								140	
Pompano							250	1		5	711			967	65
Rock Bass										285	101,156	14,905	19,314	135,660	700
Rockfish	6,003	6,895	20				341,182	52,316	173,019	10,952	102,812	13,451	81,410	788,360	3,775
Sablefish							117,926	180,971	330					299,227	
Salmon	785,174	1,090,491		485,398		731,035	693,897	6,112	5,835					4,077,013	
Sandabs							186,651	14,450	2,227		2,502			205,830	
Sardines							58,390	2,715,689	12,210,626	4,500	15,185	1,207	180,199	15,185,796	
Sculpin											4,153		183	4,336	
Sea Bass—Black										928	8,399		6,398	15,725	3,478
Sea Bass—White			8,785			280	16,182	13,419	551	38,317	552,045	3,365	99,959	732,906	192,423
Sea Trout							30			800	27	834	387	2,078	
Shad				46	29	17,159	31							17,265	
Shad—Buck				60		162								222	

Shad—Roe	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Sheepshead	....	....	....	....	....	....	....	....	....	90	212	....	112	414	....
Skates	....	....	....	....	....	....	4,440	125	28	....	100	....	....	4,693	....
Skipjack*	....	....	....	....	....	....	....	3,905	....	....	357,564	159	720,874	1,082,502	140
Smelt	19,726	....	927	....	....	....	12,600	50,571	51,966	23,891	23,079	19,813	4,174	206,747	1,184
Sole	10	53	....	....	....	....	1,312,440	115,945	6,885	1,370	1,036	59	....	1,437,798	....
Splittail	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Striped Bass	....	....	180	719	942	42,399	38,883	....	....	....	....	....	....	83,123	....
Stingaree	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Suckers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Surf Fish	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Swordfish	....	....	....	....	....	....	....	....	....	....	13,288	....	450	13,738	....
Tomcod	....	....	....	....	....	....	11,609	375	....	....	....	....	....	11,984	....
Trout—Farm	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Trout—Steelhead	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Tuna	....	....	....	....	....	....	....	....	....	26	360,215	5,935	798,433	1,164,609	8,738
Tuna—Bluefin	....	....	....	....	....	....	....	....	....	....	1,829,328	....	....	1,829,328	....
Tuna—Yellowfin	....	....	....	....	....	....	....	....	....	....	1,172,916	....	....	1,172,916	....
Turbot	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Whitebait	....	....	116	....	....	....	1,343	....	....	....	....	....	....	1,459	....
Whitefish	....	....	....	....	....	....	....	....	....	420	1,525	....	610	2,555	....
Yellowtail	....	....	....	....	....	....	....	....	....	7,430	470,047	5,520	266,222	749,219	30,902
Miscellaneous	14	....	....	....	....	1,469	20,347	4,009	989 796	898	15,168	511	....	1,032,212	....
Croakers	....	....	....	....	....	....	....	....	....	....	2,076	8	....	2,084	....
Total fish	832,626	1,159,488	13,353	486,398	281,143	804,107	3,247,117	3,201,982	14,753,576	268,169	17,311,443	96,580	6,439,284	48,895,266	892,205
Crustaceans:															
Crabs (doz.)	200	....	....	....	....	....	796	....	....	....	....	....	....	996	....
Ecrevisse (doz.)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Shrimps	....	....	....	....	....	73,194	219,405	....	....	....	....	....	....	292,599	....
Spiny Lobsters	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mollusks:															
Abalones	180	....	....	....	....	....	....	....	537,619	1,056	....	....	....	538,855	....
Clams—Cockle	70	16	1,798	....	....	....	....	....	....	....	....	....	....	1,884	....
Clams—Mixed	1,430	....	7,271	....	....	820	....	....	....	....	....	....	....	9,521	....
Clams—Pismo	....	....	....	....	....	....	....	....	....	54,403	....	....	....	54,403	....
Clams—Softshell	390	702	14,500	....	....	26,533	12,017	....	....	....	....	....	....	54,142	....
Cuttlefish	....	....	....	....	....	....	1,825	812	3,512	....	....	....	....	6,149	....
Limpets	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mussels	....	....	....	....	....	73	26	....	2,875	....	....	....	....	2,974	....
Oysters—Eastern (No.)	....	....	595,757	....	....	....	....	....	....	....	....	....	....	595,757	....
Oysters—Native	....	....	220	....	....	....	....	....	....	....	....	....	....	220	....
Snails	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Squid	....	....	....	....	....	....	....	....	32,643	....	1,205	....	....	33,848	....
Miscellaneous:															
Frogs (doz.)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Terrapins (doz.)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Turtles	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

All amounts shown in pounds unless otherwise specified. *Albacore and Skipjack cleaned. All other fish in round.

VIOLATIONS OF FISH AND GAME LAWS.

July 1 to September 30, 1921.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without a license	26	$330 00
Hunting in refuges	5	80 00
Hunting on posted ground	1	25 00
Alien hunting with citizen's license	1	50 00
False statement to secure license	1	25 00
Deer—closed season—killing or possession	5	175 00
Does, spike bucks, fawns—hunting, killing or possession	35	1,775 00
Deer meat—closed season—possession	14	325 00
Bear meat—closed season—possession	2	25 00
Rabbits: cottontail, brush—closed season—killing or possession	21	470 00
Tree squirrel—closed season—possession	1	50 00
Quail and pigeons—closed season—possession	19	752 50
Doves—closed season—possession or killing—excess limit	20	550 00
Ducks—closed season—possession	6	100 00
Birds: non-game—closed season—possession	7	5 00
Birds: game—in captivity without permit		25 00
rail—closed season—possession		00

SEIZURES.

Fish and Game, and Illegally Used Fis

Game.	
Bear meat	10 pounds
Deer meat	515 pounds
Deer	6
Spike buck	1
Spike buck head	1
Ducks	128
Doe	1
Doves	23
Deer skin	1
Meadow lark	1
Mocking birds	6
Non-game birds	3
Pheasants	4
Quail	27
Rabbits	23
Sage-hen	1
Woodpecker	1

Fish.	
Abalone	942
Black bass	34
Striped bass	190 pounds
Barracuda	130 pounds
Clams (Pismo)	504
Crabs	25 doz.
Crabs	47
Crappie	22
Eels	15
Lobsters	32
Lobsters	170 pounds
Salmon	18
Salmon	100 pounds
Sturgeon	225 pounds
Trout	1
Yellow fin croaker	3,200 pounds
Illegal nets	7
Searches	15

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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A HISTORY OF FISHCULTURAL OPERATIONS IN CALIFORNIA.

By W. H. SHEBLEY, in charge Department of Fishculture.

The California Fish Commission was created by an act of the legislature, entitled "An act to provide for the restoration and preservation of fish in the waters of the state," approved April 2, 1870.

The United States Commission of Fish and Fisheries was established by joint resolutions of Congress, approved February 9, 1871. California, therefore, had an organized fish commission nearly a year before the federal government took up the work of multiplying the food fishes and thereby increasing the food resources of the United States.

The object of the first endeavors of the California Fish Commission was the introduction and acclimatization of new species of food and game fishes. As eggs could be obtained more easily than adult fish, suitable hatcheries for the hatching of eggs became a necessity.

ACCLIMATIZATION SOCIETY HATCHERY.

The California Acclimatization Society, under the supervision of Mr. J. G. Woodbury, first began experimenting, and had made several successful hatches of eggs introduced from the Eastern states previous to the establishment of a state fish commission. A small hatchery, situated near the City Hall in San Francisco, was utilized in this pioneer work.

STATE HATCHING HOUSE AT BERKELEY.

The first hatchery owned and operated by the state was situated on the grounds of the State University at Berkeley. Up to 1873 the Acclimatization Society actually operated this hatchery and was paid by the Fish Commission for the trout reared.

CLEAR LAKE EXPERIMENTAL HATCHERY.

In the early seventies, also, a temporary station was operated on Kelsey Creek, tributary to Clear Lake, for the purpose of hatching a shipment of whitefish sent to the California commission by the United States Fish Commission. Eastern brook trout, landlocked salmon and whitefish, as well as the native varieties, were propagated with some success, but the location was not suitable for carrying on the work on a large scale.

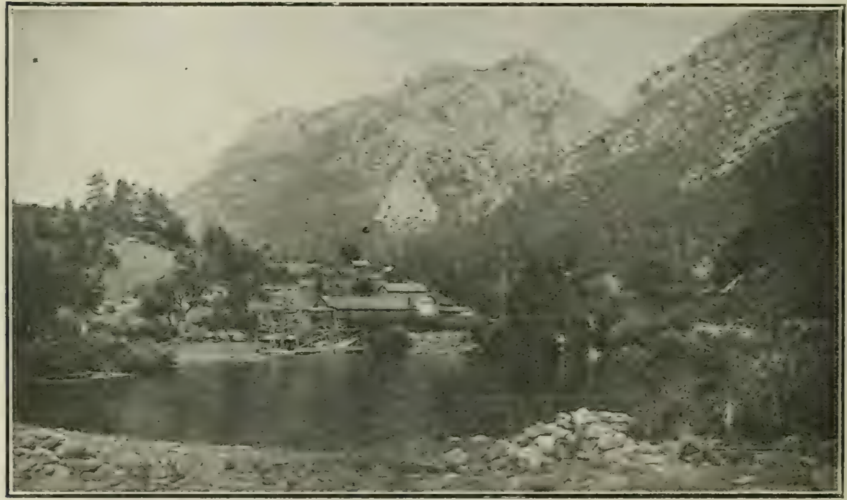


FIG. 32. United States Fish Hatchery at Baird, Shasta County, in July, 1882. This was for many years the most important salmon-egg collecting station in California.

BAIRD HATCHERY.

The circumstances surrounding the establishment of the first salmon hatchery are as follows: In 1872 the United States commission instructed Dr. Livingston Stone to proceed to the Pacific Coast and there obtain a supply of salmon eggs from the Pacific salmon. Dr. Stone was at that time one of the recognized authorities on fishculture in the United States. He had been engaged in the work of fishculture for a number of years in New Hampshire and other Eastern states, was a man of education and a close observer of all things in nature. Dr. Stone arrived in San Francisco in August, 1872. He could gain no reliable information regarding the habits of the Chinook salmon or where they spawned. A general impression prevailed that the spawning grounds were near the confluence of the Sacramento and San Joaquin rivers, but after an investigation of this region Dr. Stone concluded that the fish spawned elsewhere. Mr. Montague, chief engineer of the Southern Pacific Company, informed Dr. Stone that he had seen salmon spawning at the junction of the McCloud and the Pit rivers. At that time the terminus of the railroad was at Red Bluff, fifty miles from the spawning grounds on the McCloud River. Dr. Stone was accompanied on his trip to this section by Mr. John G. Woodbury, who had been in the employ of both the California Acclimatization Society and the California Fish Commission.

After many hardships and struggles to obtain material and supplies, they succeeded in establishing on the McCloud River the first salmon-breeding station on the Pacific Coast, naming it Baird, in honor of Spencer F. Baird, Commissioner of Fisheries. The summer run of salmon was nearly over and, judging from Dr. Stone's report, the salmon run in the Sacramento River was very much depleted. From the advent of the whites up to this time, there had been a great demand on the salmon of the Sacramento River; and with no hatcheries to increase their numbers, no adequate laws to protect the breeding fish (and with the great spawning grounds of the Feather, Yuba, Bear and American rivers destroyed by the mining operations on their headwaters), in a few years little was left of the great run of fish that had previously entered these waters. The salmon had abandoned them altogether, as the eggs deposited on the spawning grounds in these streams did not hatch, being destroyed by the detritus from the mines. The only natural spawning grounds left to the salmon were in the tributary rivers that formed the headwaters of the Sacramento River, the principal streams being Mill Creek, Battle Creek, Pit River and its tributaries, Hat Creek and the McCloud River, and the main Sacramento River, above the mouth of the Pit. These proved to be good salmon streams, but the great drain on the salmon and the destruction of nearly one-half of the spawning beds, soon greatly diminished their numbers.

The first season's operations on the McCloud River, by Dr. Livingston Stone and his assistants, were experimental to a great extent. Only 50,000 eggs were taken, and of this number but 30,000 were fit to ship when they had developed to the proper stage. The eggs were shipped to a hatchery in New Jersey and 7000 hatched; and on the advice of several state commissioners and fishculturists the fry were planted in the Susquehanna River. The following season the Baird Hatchery was enlarged and the work of collecting and hatching salmon eggs was begun in earnest. From 2,000,000 to 14,000,000 eggs were taken annually at this station from 1872 to 1883.

In 1881 the plant was destroyed by a freshet, but was immediately rebuilt. The California Fish Commission assisted in the work at Baird by paying a portion of the operating expenses, and in return received eggs for hatching and fry for planting. The main object of this hatchery for the first few years was to secure eggs to ship to the East for the purpose of introducing Pacific salmon in the waters of that section. The commission early made an agreement with the State of California, however, under which the latter at first paid part of the expense, while the commission hatched and planted a portion of the take in the McCloud River. Later, part of the eggs were turned over to the state, which hatched and planted the salmon in local waters.

About 25 per cent of the total number of eggs taken during this time were hatched at this station, and the fry each season were liberated in the McCloud River, under the supervision of Dr. Stone, superintendent of the hatchery. The cost of hatching and planting was borne by the California Fish Commission. The remaining eggs were shipped to the Eastern states and to foreign countries. Shipments of the Chinook salmon were made to the principal countries of Europe and also to Japan and New Zealand.

In 1883 the United States commission quit operations on the McCloud River. Only 1,000,000 eggs had been taken during the season, this being the smallest take in the history of the work on this stream since the preliminary work of 1872. This great falling off in numbers was due largely to the heavy blasting and other operations on the line of the railroad which was then being constructed from Redding northward. The salmon undoubtedly were frightened so that they did not ascend the Sacramento River; besides, a great many were taken by the grading gangs and used in the camps for food. Thousands of trout and salmon were destroyed by powder used by the Chinese and white laborers, of whom there were 9000 camped along the Sacramento River; and while a great many of the fish were used as food, there was wanton destruction in the way they were killed. The same condition existed in 1884, and Superintendent Stone recommended that the station be not operated that season. It remained closed from that date until 1888, the year that the Sisson hatchery was established by the state.

SAN LEANDRO HATCHERY.

Finding the state hatchery house at Berkeley too small for the quantities of fish required to be hatched, as well as lacking in a reliable water supply, a larger hatching house was built on Lake Chabot, on the property of the San Leandro Water Works, near San Leandro, California, in 1878. Here much of the trout work was carried on until the Shebley Hatchery in Nevada County was taken over by the state.

SHEBLEY HATCHERY.

In 1883 the California Fish Commission abandoned the San Leandro Hatchery, located near Lake Chabot in Alameda County, owing to the fact that the water was too warm for successful hatching and rearing to be accomplished during the warmer months of the year; also, the water was not suitable for the propagation of healthy fry.

A site was selected in Nevada County on the ranch of Mr. J. V. Shebley, who donated to the state the use of the site and the water for hatchery purposes. The first superintendent was Mr. J. A. Richardson, a fishculturist formerly employed by the United States commission at Baird, and by the California Fish Commission, as an assistant to Mr. J. G. Woodbury at the San Leandro Hatchery.

The work accomplished at the Shebley Hatchery was limited, owing to the small amount of money appropriated and the great cost of transporting the fry to the waters to be stocked. The commission had to pay expressage on all shipments of eggs and fry distributed. The principal work was the hatching of rainbow trout, the black-spotted trout of the Tahoe basin, and also a number of shipments of eastern brook trout and landlocked salmon. This hatchery was operated until 1888, when the board decided to establish larger hatcheries located near the egg-collecting stations, where an unlimited supply of water could be had. Accordingly, in 1888, after the distribution of fry was over for the season, the Shebley Hatchery was abandoned, and in the following spring the tools and apparatus that were the property of the state were shipped to the new hatchery on Lake Tahoe, at Tahoe City.

FRAZIER HATCHERY.

Frazier Hatchery was established in 1875 by I. C. Frazier, on Squaw Creek, Nevada County, under permit and authority granted by the State Fish and Game Commission. This hatchery was operated until 1880, when it was abandoned.

HURLEY HATCHERY.

The Hurley Hatchery was established in May, 1880, by John Hurley under permit from the Fish Commission. During that year there were hatched and distributed over 95,000 trout. Captain Todman, with the authority of the commission, leased the hatchery and hatched and released over 500,000 trout during the year 1887. The commission in 1888 took over the hatchery, and before the end of June had hatched and distributed over 600,000 trout.

HAT CREEK HATCHERY.

In 1885 the California Fish Commission decided to establish a hatchery for the propagation of salmon, as the federal government had not again resumed operations at Baird, on the McCloud River. After examining a number of sites, it was decided to establish a hatchery on Hat Creek, with the exception of Fall River the largest tributary of the Pit. Hat Creek is a large stream, carrying about 26,000 miner's inches of water, and is not subject to sudden floods. The commission had the plans of the hatchery made after the design of the old Baird Hatchery and let the work out by contract. The hatchery was a large building for those days; it was constructed of good material, was 100 feet long, 46 feet wide, and contained 64 hatching troughs when completed. It had a capacity of 90 troughs, but all were not put in, as the run of salmon did not justify the expense. There was a complete filtering plant and the hatchery was fully equipped to care for from 6,000,000 to 10,000,000 eggs. The year following its completion, Mr. J. V. Shebley took charge of the station. He began operations early in August, but although trapping and seining for the spawning salmon

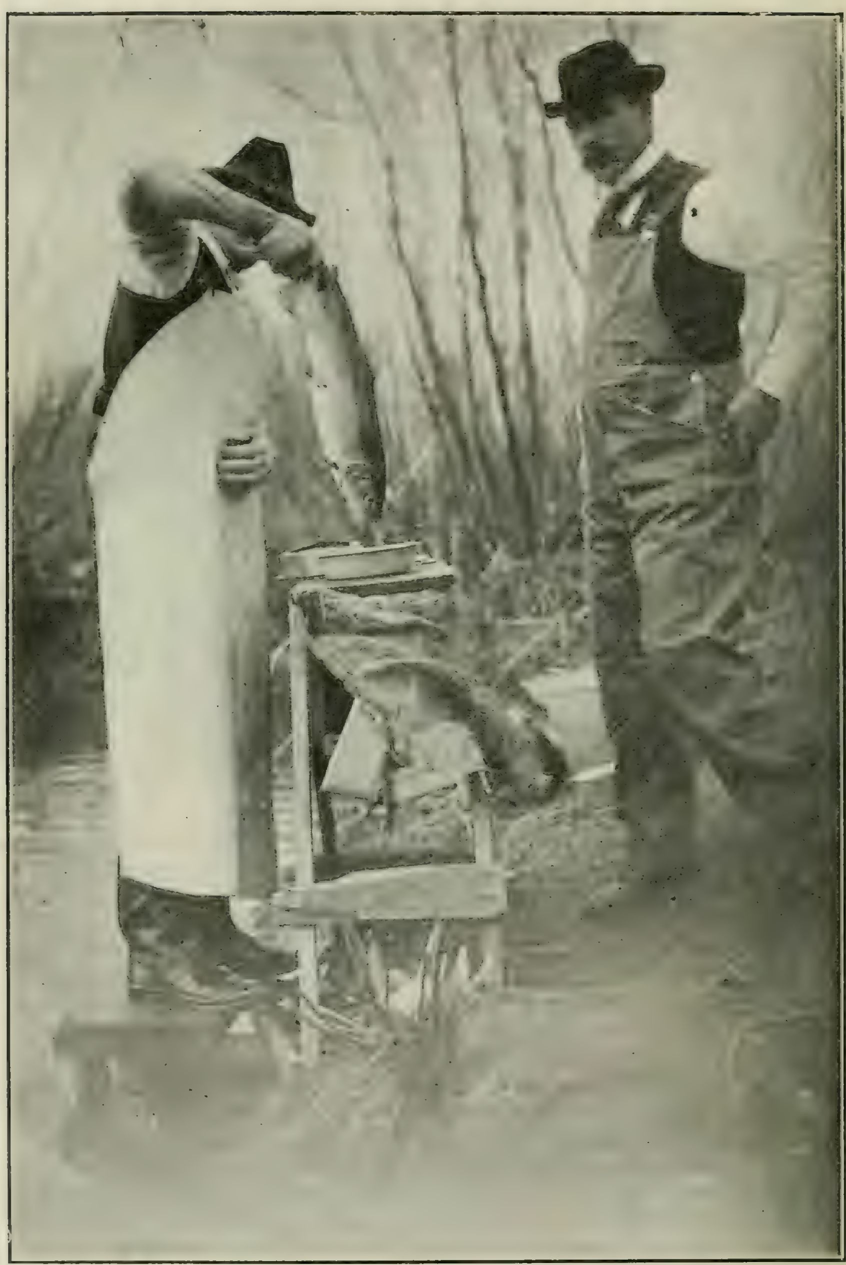


FIG. 33. W. H. Shebley and H. E. Southern examining Klamath River trout on Cottonwood Creek, near Hornbrook, Siskiyou County, about 1904.

was continued until November, only 1,200,000 eggs were collected. The spawning beds that a few years before had been covered with thousands of spawning fish were now deserted. In 1887 W. H. Shebley was appointed superintendent of the Hat Creek station, to succeed J. V. Shebley, who resigned from the commission to engage in private business. The take of eggs the second year was less than that of the first. Every effort was made to procure sufficient eggs to justify the commission's operating the plant, but only 500,000 were taken.

In the spring of 1888 Superintendent W. H. Shebley recommended to the Board of Fish Commissioners and to Governor Waterman that the Hat Creek Hatchery be either abandoned or closed down for a number of years, and that a station be established lower down the river at a place where the salmon eggs could be collected and shipped to a hatchery along the line of the railroad. It was demonstrated beyond any doubt, during the two seasons that Hat Creek station was operated, that the spawning salmon did not reach Hat Creek, nor the Pit River near its confluence with Hat Creek, in numbers sufficient to justify the expense of operating the station any longer. In former years a large run of salmon ascended Pit River as far as the falls below the town of Fall River Mills, and also into Hat Creek; but owing to the diminishing number of salmon in the Sacramento River and its tributaries, the fish that ascended the river found ample spawning beds lower down, near the confluence of the Pit, the Sacramento and the McCloud rivers. The board, acting on this recommendation, ordered the hatchery closed and began looking for another site.

MOUNT SHASTA HATCHERY.

In August, 1888, Mr. J. G. Woodbury was appointed superintendent of hatcheries of the California Fish Commission. He immediately began to look for a suitable location for a large hatchery along the line of the railroad, at the headwaters of the Sacramento River. After making a thorough examination and a study of the conditions of the different streams, it was decided to locate the hatchery on Spring Creek, near the town of Sisson, on the property of Mr. J. H. Sisson. Spring Creek has its source in a large spring about a mile from the hatchery; the water is pure and cold and its temperature does not vary to great extremes. The good judgment shown by Mr. Woodbury and Dr. Stone in selecting this location has been proved by the successful work done at Sisson during the ensuing years.

The first hatchery on this site was built in the fall of 1888. It was a plain wooden structure 40 by 60 feet, containing 44 troughs, and was hurriedly constructed to accommodate the eggs that were being collected by the United States commission at Baird from the fall run of salmon in the McCloud River; for the federal commission had resumed operations on the McCloud River, after having closed the station for five years. An agreement had been entered into whereby the United States commission and the California commission were to divide the work of propagating salmon in California; the former was to collect and prepare the eggs for shipment, the latter to hatch and distribute them.

The Sisson Hatchery was completed and ready for operations in September, 1888. The floods did not interfere with the work, and Dr. Stone operated until late in November. Eight hundred thousand eggs were collected from the early fall run and 2,200,000 from the October and November, or late fall run. These eggs were hatched and the fry fed until they were large enough to care for themselves and then carefully distributed in the upper reaches of the Sacramento River and its tributaries.

The policy of feeding the fry was continued until 1895, when it was discontinued by the Board of Fish Commissioners as a matter of economy coupled with a wrong idea that had been advanced by those who were dictating the policy of the fishcultural operations in California that the salmon fry were better off if distributed as soon as the umbilical sac was absorbed. The benefit of feeding the fry was plainly demonstrated by the great increase of the salmon in the Sacramento River in the years that followed the return of the output of fry from 1888 to 1896.

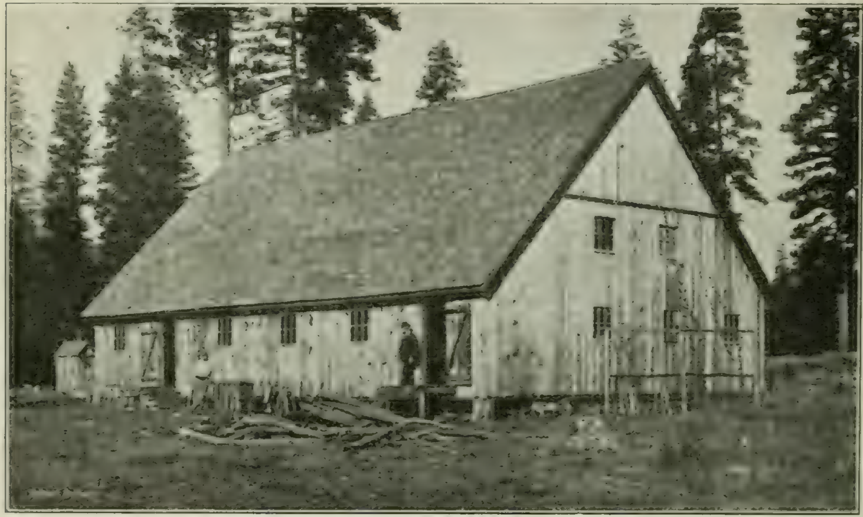


FIG. 34. The old Sisson Hatchery in 1894.

The fry at the Mount Shasta Hatchery are first held and fed in the troughs about two months before they are removed to the ponds. Then they are taken out in small lots and fed until all are accustomed to the new surroundings. The pondkeeper distributes the food slowly at the different feeding stations in the ponds, until he is satisfied that all the fry have received their share of food. By this method the fry all make the same development and growth, and there is no danger of developing a lot of precocious fry to exercise their cannibalistic instincts on the others.

In 1911 it was decided to again hold and feed the salmon fry until they were large enough to care for themselves when distributed, as well as to hold a large number of them in the ponds at the Mount Shasta

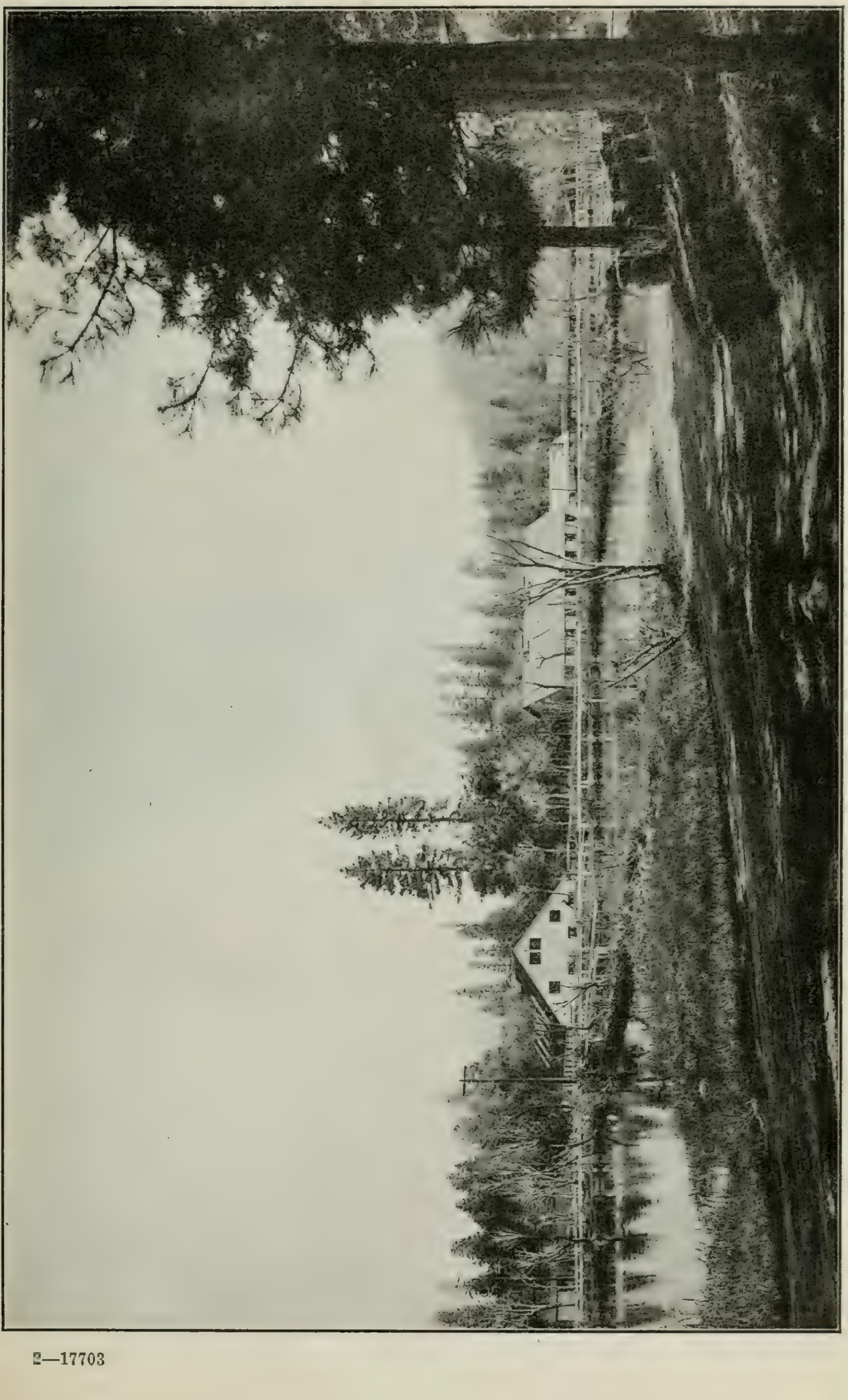


FIG. 35. Sisson Hatchery in 1916. On the grounds are five large hatchery buildings, several smaller hatching houses, and cottages for employees.

Hatchery until fall and then release them in the upper reaches of the Sacramento River during the early fall, before the winter floods. During the season of 1913 three quarters of a million salmon fry were held in the ponds at this hatchery and released during October. During the season of 1914, 21,000,000 salmon fry were held in the troughs, nurseries and ponds and fed until late in the spring. Of this number, 4,000,000 were placed in the large ponds at the Mount Shasta Hatchery in perfect condition, where they were fed daily and looked after by skilled fishculturists until the early fall, when they were released, so that their descent of the river might be less hazardous and a greater number might reach the ocean than is the case with the fry released in the spring or summer. This policy of holding and feeding all of the salmon fry before releasing them, and then only when the flood season is over in the spring, has unquestionably given good results. It is believed that it was the holding and feeding of the fry in the early history of the Mount Shasta Hatchery that increased the run of salmon in the Sacramento River, and that the present run is largely due to these efforts.

During the year 1913 three new ponds were constructed for the rearing of brood fish, making in all a total of fifty-one ponds and nurseries. With the increasing demand for fish to stock streams, it was found necessary to increase the pond system sufficiently to raise enough stock fish to supply the eggs.

Located as it is at an altitude of 3500 feet above sea level, on the southern slope of Mount Shasta and in the heart of Strawberry Valley, with a wonderful supply of pure cold water, within a mile of the main line of the Southern Pacific Railroad and but a couple of hours by rail from the rainbow trout egg-collecting stations on the Klamath River, Mount Shasta Hatchery is ideally situated. It not only has a capacity for handling the bulk of trout fry, but is also capable of rearing a sufficient number of salmon fry to maintain the salmon run in the Sacramento River.

The development of this hatchery from a small salmon hatchery to its present size has been gradual. Each year permanent improvements have been made. From the first small permanent building, 40 by 60 feet, containing 44 troughs, erected in 1888, the plant has been enlarged until at the present time it includes seventeen acres of land owned by the state, with a water right of 700 miner's inches; fifty-one ponds and nurseries for the rearing of thousands of fish; five hatchery buildings containing 450 troughs; a superintendent's residence; three cottages for the foreman and assistants; a spawning house; a barn, sheds, garage and other buildings, and an electric lighting plant. The value of the lands and improvements, together with the apparatus and equipment necessary to maintain a station of this size, estimated at the cost of the purchase price and of construction, is $100,000. In addition to this equipment, the commission has leased outside the grounds but within a radius of a quarter of a mile of the plant, three large ponds which are used for rearing salmon fry. The capacity of these ponds is 3,000,000 fry. A one and a half-ton truck is used for hauling materials and supplies from the town of Sisson, which is one mile distant, and for hauling fish and eggs to and from the trains. As many as

100,000 fish are retained in the fifty rearing ponds as breeders. Ten to thirty million trout and salmon are hatched and reared at the station each year.

MILL CREEK AND BATTLE CREEK HATCHERIES.

The work of collecting salmon eggs has been systematically carried on by the joint operations of the federal and state commissions, with the object of increasing the number of salmon in the Sacramento River. Two hatcheries have been established for the work, one at Battle Creek, in 1895, by the state commission; the other at Mill Creek, in 1902, by the federal commission.

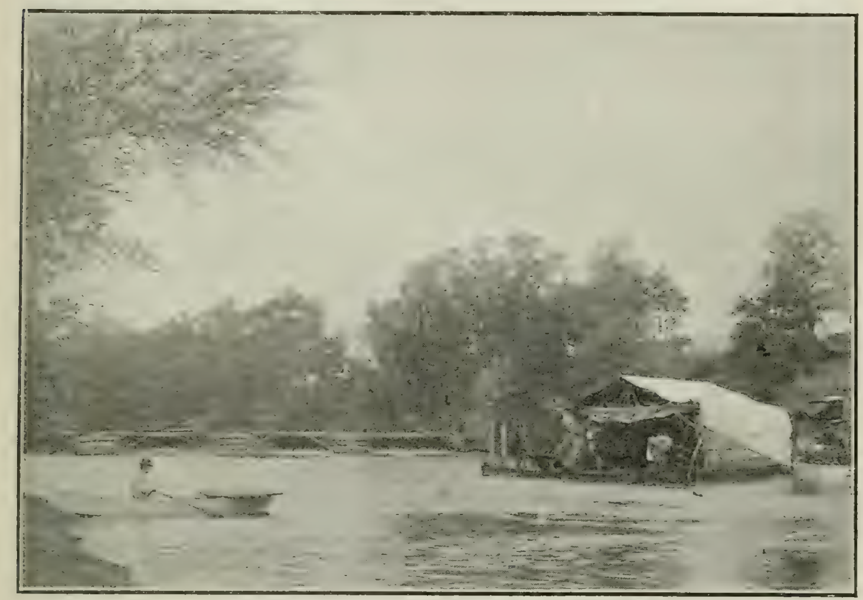


FIG. 36. The first salmon-egg collecting station on Battle Creek in 1905. In the first year of operation the take amounted to ten million salmon eggs.

The Battle Creek Hatchery has proved to be one of the greatest salmon-spawning stations in the world, as many as 60,000,000 eggs having been taken in one year. It was largely due to the efforts of Mr. John P. Babcock that this fine station was located. He had taken a keen interest in the propagation of salmon and recommended this site to the California Fish Commission. Battle Creek is one of the large tributaries of the upper Sacramento River; it rises in the watershed of Mount Lassen and flows into the Sacramento River about twenty miles north of Red Bluff. There is a lagoon two and a half miles long at its mouth, in which the fall-run salmon gather in thousands. The California Fish Commission operated this station for two years, but owing to a lack of funds, and desiring to see the station operated to its fullest capacity, a proposition was made by the state commission to Hon. J. J. Brice, then United States Commissioner of Fisheries, to purchase the plant for a government station, the money thus obtained to be applied to increasing the capacity of the Sisson Hatchery. Commissioner Brice accepted the proposition and laid the matter before Congress, and the necessary appropriation for purchasing the station was made. The eggs collected at this station, as well as at the other federal stations in the state, have been largely turned over to the California commission for hatching and distributing. During the two years that the Battle Creek station was operated by the California commission, Messrs. E. W. Hunt, superintendent of the Tahoe Hatchery, and W. H. Shebley, superintendent of the Sisson Hatchery, cooperated in the immediate supervision of the work.

The salmon have gradually increased as the result of artificial propagation and the protection of the spawning salmon on their way to the breeding grounds at the headwaters of the Sacramento River and its tributaries. As an illustration of the wonderful results obtained, the United States commission collected and shipped to Sisson from the summer run of 1888 but 800,000 eggs, and 2,000,000 from the late fall run. With this small beginning, the great work of restocking the Sacramento River gradually increased until, during the season of 1905–1906, the federal Bureau of Fisheries collected 100,000,000 salmon eggs at the three stations—Baird, Mill Creek and Battle Creek. During the season of 1903–1904, there were hatched at the Sisson Hatchery 58,000,000, and in the season 1905–1906, 96,000,000 salmon eggs. This great work was made possible by the construction of batteries of troughs outside of the buildings, in which to hatch the surplus eggs, the nurseries being used to rear the fry, as they could not be held in the troughs until large enough to be liberated.

MILL CREEK EGG-COLLECTING STATION.

This station is the property of the federal bureau, but was operated in 1912 by the California commission. Theretofore the salmon eggs had been hatched largely at Sisson, and as the prospects were unusually promising for the previous season it was feared the capacity of the Sisson Hatchery would be overtaxed. Accordingly, arrangements were made with the federal bureau whereby the state operated the Mill Creek station.

During the year 1902 a substation was established on Mill Creek, a stream which has its source in the foothills of the Sierra Nevada Mountains, in the northeastern part of Tehama County, and empties into the Sacramento River from the east about a mile above the town of Tehama. The eggs were retained here until eyed, and then were shipped to other hatcheries.

REDWOOD CREEK AND KORBEL HATCHERIES.

Continuing to increase their salmon operations, the United States Fish Commission in 1889 erected a salmon hatchery at Fort Gaston, in the Hoopa Indian Reservation in Humboldt County. An additional egg-collecting station was established on Redwood Creek in 1893, and the same year a new hatchery was built near Korbel, on Mad River, but on account of inaccessibility, all three stations were abandoned in 1898.

LAKE TAHOE HATCHERY.

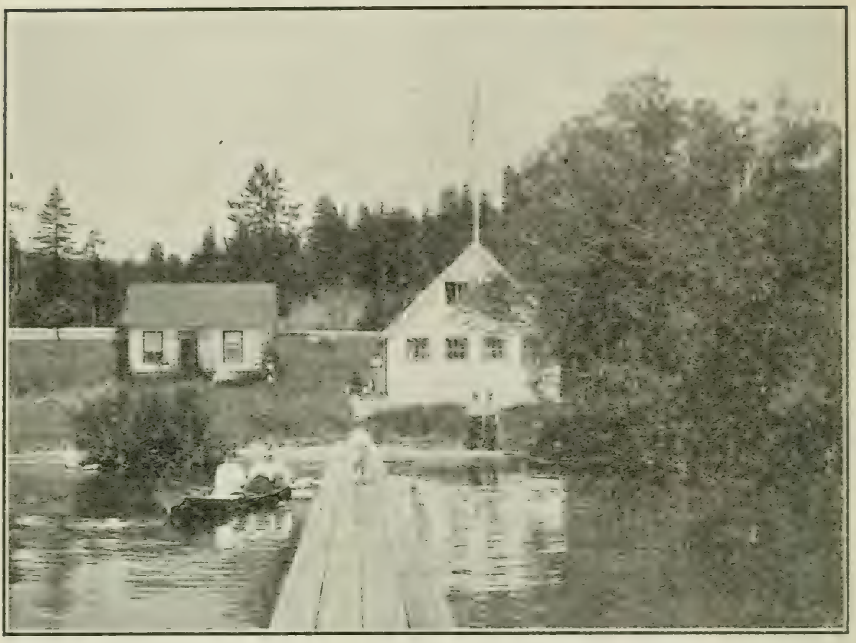
In the spring of 1889 Superintendent Woodbury, acting under instructions from the Board of Fish Commissioners, decided to locate a permanent hatchery on Lake Tahoe. The state had been carrying on hatchery operations under the direction of Mr. I. C. Frazier, in a rented building that was not properly equipped to do good work. Each season a few hundred thousand eggs had been taken from the black-spotted trout of Lake Tahoe and shipped to the Shebley Hatchery in Nevada County, and when the fry were hatched they were shipped back to the Truckee and Tahoe region and distributed.

After a study of conditions the hatchery was located near Tahoe City, at the north end of the lake. The water supply was furnished from springs rising on the land used as a hatchery site. Thirteen acres were first rented, but later purchased so as to secure all the available water to be had near the site. At this hatchery millions of black-spotted trout were annually reared until 1916.

During the season 1891 the Tahoe Hatchery, as well as the other hatcheries, was not operated, owing to dissension among members of the board. Three private hatcheries, located at Del Monte, Glen Ellen and Alma, were supervised by the state for a few years, but the resulting hatch was negligible. In 1892 the Sisson Hatchery was reopened but the Tahoe Hatchery was not reopened until 1894, when Mr. E. W. Hunt was appointed superintendent. The work of propagating the black-spotted trout of Lake Tahoe was systematically taken up by Mr. Hunt, and the increased number of fish in the Tahoe region is evidence of his energetic and intelligent work. The increase of trout in Lake Tahoe, like the increase of salmon in the Sacramento River, is well demonstrated by the work of the egg-collecting stations. In 1890 the commission seined on all the available places in the lake where it was thought spawning fish could be taken, besides operating traps in three of the best creeks flowing into the lake, and only 873,000 eggs were procured. In 1910, 6,000,000 were taken at the Taylor Creek egg-collecting station alone.

THE NEW LAKE TAHOE HATCHERY.

By 1916 it had become more and more evident that the supply of water at the old site of the Tahoe Hatchery was entirely inadequate. Consequently, during the fall of 1917, a survey was made of all the available and suitable streams flowing into Lake Tahoe, and after a careful examination a site was selected at Walker Springs, one mile north of the present site, on the state highway. The Walker Springs run, during the minimum flow, 30 inches of water, and during the maximum flow a couple of hundred inches; and this during the season of greatest hatchery activity. Therefore the state secured a most desirable site to carry on hatchery work, and the only suitable water for hatchery purposes in the Tahoe Basin proper. The streams that have their sources in the mountain range surrounding Lake Tahoe carry too much detritus and are too roily during the time the snow is melting. After purchasing the property, plans were made by the state architect for a modern stone hatchery with four times the capacity of the old



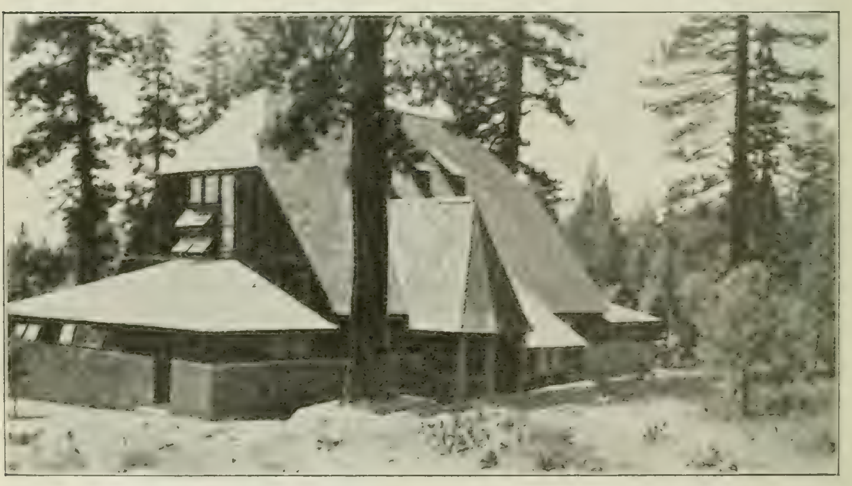


FIG. 37. (Above) The old Tahoe Hatchery as it appeared in 1906. (Below) The new Tahoe Hatchery completed in August, 1920.

hatchery. The contract was given to Mr. Matt Green during the summer of 1919. Work was begun on the new hatchery that fall and was completed in the fall of 1920.

The new hatchery contains 64 troughs and has a capacity of about two and a half million trout. Provision has also been made for breeding ponds and nursery ponds and a superintendent's cottage. This new hatchery was made the more necessary because of the lack of water at the Tallac Hatchery during the past few years. The new Tahoe Hatchery is of sufficient size to handle practically all of the black-spotted trout operations.

At the request of Governor Stephens and the citizens of Placer County, the old hatchery grounds were converted into a public camping ground by an act of the legislature during 1918, and the management of this public park was placed with the Fish and Game Commission, which has improved and maintained it from the funds collected from hunting and angling licenses.

MOUNT TALLAC HATCHERY.

In 1895 Lawrence and Comstock erected a temporary hatchery near Tallac, about two miles from the mouth of Taylor Creek, and placed it under the control of the commission. The following year operations were moved to Tallac Creek. For a number of years a good proportion of the eggs taken in the vicinity were hatched at this station and distributed in the public waters of that region. However, owing to the distance from the spawning grounds and the small supply of water, it was decided in the fall of 1908 to abandon this hatchery and erect a substantial modern building on Taylor Creek near Tallac, where a large supply could be obtained and where the work of hauling the eggs to the hatchery in the early spring, when the country is covered deep with snow, would not be so difficult. After securing a lease for a term of years from Mrs. Anita M. Baldwin, the new building, 40 by 70 feet, was erected. It has a capacity of 3,000,000 eggs and is splendidly equipped. Since a dam was erected on the stream above the hatchery, however, water conditions have not been so good.

GLEN ALPINE HATCHERY.

Through the joint efforts of Mrs. George Pierce of Glen Alpine Springs, and Professor W. W. Price of Alta, a small hatchery was completed at Glen Alpine in 1905 and was operated as an auxiliary to the other two Tahoe stations until 1912. It was only a small building, the property of the Glen Alpine Hotel Company, having a capacity of 1,000,000 eggs, and was used by the commission to hatch out a few hundred thousand eggs to save the cost of transportation of the fry.

BEAR VALLEY HATCHERY.

To satisfy the feeling of necessity for a hatchery in the vicinity of San Francisco, and after careful examination of the waters of the neighboring counties, Bear Valley, in Marin County, was finally selected as the site for this hatchery, which was erected in the fall of 1891. It was operated as a trout station during the seasons of 1892 and 1893, but was closed for trout work in 1894. Owing to the limited supply of water and the great distance from the railroad, it was considered neither economical nor expedient to operate this station longer. The efforts of the board were to concentrate the principal trout work at Sisson, aside from the work done at the Tahoe Hatchery for the propagation of the black-spotted trout of that region.

WAWONA HATCHERY.

In 1895, under the supervision of W. H. Shebley, a small hatchery was erected at Wawona, to provide fish for the lakes and streams in the Yosemite Park and adjacent country. The hatchery was erected and equipped by the Yosemite-Raymond Stage Line and turned over to the commission to be operated upon condition that an annual hatch of 500,000 trout eggs should be distributed in that vicinity. It was managed for a number of years by Mr. M. L. Cross, who was remarkably successful in the work, principally that of hatching rainbow trout eggs and eggs of the black-spotted trout of the Tahoe Basin. The eggs were shipped to this station, and the fry distributed throughout the lakes and streams of Yosemite National Park and the surrounding country. The German brown trout also has been distributed in a number of the lakes and streams, and has done remarkably well.

By 1916 the hatchery and equipment had become so old that operations were suspended. In 1918, however, a new hatchery was constructed on the old site and the old equipment temporarily installed. Later the newer equipment from the Yosemite experimental hatchery was substituted.

PRICE CREEK HATCHERY.

In its endeavor to increase the salmon supply in California the commission investigated conditions on Eel River, and in 1897 a hatchery was erected on Price Creek, one of the tributaries of Eel River, about twelve miles from its mouth.

The first eggs were shipped from Battle Creek to the new station in December of that year. This station proved to be a great success. Eel River, like the headwaters of the Sacramento, has no predatory fish except the trout to devour the salmon fry. The water of the river from the mouth of Price Creek to the ocean flows through deep pools, with very little current. The salmon fry find perfect conditions in this stretch of water, and enter the ocean with very little loss and in fine condition. This station has also been used for collecting and hatching steelhead eggs for distribution in the streams in Humboldt County. The increase of salmon in Eel River, following the establishment of this station, is another example of the benefit derived from artificial propagation. At the time the first salmon fry from the hatchery were liberated in Eel River during the spring of 1898, the average annual shipment of salmon from Eureka was about 500,000 pounds. After the establishment of the hatchery there was a steady increase, and in 1904 the shipment was over 1,500,000 pounds.

A most remarkable example of artificial propagation of salmon is shown at this important station. This hatchery, in Humboldt County, was established in 1897, at which time the average number of pounds of salmon shipped from Eureka per year was less than 500,000. In 1899, 470,806 pounds were shipped from this territory. Five years later, 1904, the total number of pounds had increased to 1,877,000.

In 1902 this hatchery made the first plant in the state of steelhead trout fry. After the spring of 1906, when the restriction prohibiting netting became effective, there was a marked increase apparent. In operating one small trap on Price Creek (which was at different times flooded) the largest number of steelhead eggs ever taken in Humboldt County was secured. In 1916 the hatchery was moved to a point on Eel River near Fort Seward.

UKIAH HATCHERY.

During the season of 1897 Mr. A. W. Foster, president of the San Francisco and North Pacific Railroad Company, being desirous of adding to the attractions of the streams along the line of his road by thoroughly stocking them with fish, caused to be built at Ukiah a fish hatchery having a capacity of 2,000,000 eggs, and arranged with the commission to supply the hatchery with trout spawn, upon an agreement from him that the fish should be planted in public waters. Mr. Foster employed competent men to operate the hatchery, and in the spring of 1897, 700,000 trout eggs were forwarded to the Ukiah Hatchery. They were there successfully hatched and afterwards liberated in the public streams of Marin, Sonoma and Mendocino counties. In the spring of 1898 the commission forwarded to Ukiah 200,000 eggs. The number was reduced because the water supply of the section was affected by the dry season. The addition of this hatchery has been and will continue to be of great assistance in stocking the 1200 miles of trout water in these counties.

In 1911 the Fish and Game Commission took over complete control of the Ukiah Hatchery, since which date it has continued operations. Several years ago improvements were made at the station in order to permit the eyeing of all the steelhead trout eggs taken at the Snow Mountain station.

MEARS AND HAZEL CREEK STATIONS.

During the early part of 1898 the commission caused traps to be placed in Mears and Hazel creeks, tributaries of the Sacramento River, near Sims, hoping to increase the output of rainbow trout. Owing to the lack of rain these creeks did not rise and the usual run of spawn fish did not attempt to ascend them, and the project was a failure. The location, however, was considered good, and the effort was renewed the next year, but as the second attempt was also a failure it was considered wise to abandon the location and try a point on the Truckee.

The expense of the work at Sims was borne by the Southern Pacific Company.

VERDI EGG-COLLECTING STATION.

Following the failure of the attempt to take trout spawn from the Sacramento River, and still desiring to increase the output of rainbow trout fry, a point on the Truckee River known as the Essex dam, near

Verdi, Nevada, was selected, where in 1902 a cheap building was constructed and fitted up as a hatchery to hold the eggs until such time as they could be shipped to Sisson and Tahoe. The lease for the land used was donated to the board by Mrs. Margaret Foulkes of Verdi, Nevada.

The spawn fish were collected from the river by means of traps placed near the fishway on the dam, directly in front of the hatchery building.

The run of rainbow trout at this point was an agreeable surprise, and was made possible by the action of all the owners of dams in the river in Nevada in placing fish-ladders on the dams and by the efforts of the peace officers of Nevada, who enforced the closed season. The Truckee River rises in California, its head being in Lake Tahoe. It passes for many miles through the mountains of California and then runs into Nevada, emptying into Pyramid Lake, so that both Nevada and California are intimately concerned in any action that will lead to the betterment of the fishing interests of this river.

The authority for operations at this point was granted by the county commissioners of Washoe County, Nevada, who appreciated the fact that California and Nevada are jointly interested in improving the fishing conditions of the Truckee River. In addition to granting this authority, the commissioners exercised their power to have the laws enforced in Nevada. Between the last of February and the first of May 538,000 rainbow trout eggs were taken. In addition 500,000 black-spotted trout eggs were taken; for lack of hatching room, however, all but 218 black-spotted trout were liberated in the river above the traps. The total number of eggs collected at the station the first year was 1,038,000, part of which were shipped to the Sisson Hatchery and part to the Tahoe Hatchery, the balance being hatched and liberated in the Truckee River near Verdi, in Nevada.

So far as trout propagation is concerned, there is no stream so naturally prolific and so responsive to propagation and protection as this mountain stream. The take in the spring of 1904 was most discouraging, although the prospects were good. There were large numbers of good-sized fish to be seen, but the heavy and continuous storms kept the Truckee River at a flood stage for several months. The gates at the outlet of Lake Tahoe, which had been closed during the summer of 1903, had stored the water to a higher level than usual. This was quickly raised by the heavy rain and melting snow until it became necessary, in order to save the property around Lake Tahoe, to open the flood gates to their full extent. The continuous flow of such a large volume carried away dams and swept a great deal of heavy debris down the river, taking out racks and traps and making it impossible to replace them. The failure to make a good collection was due solely to the unusual conditions, the total take being about 75,000 eggs, 35,000 of which were eyed and sent to the United States Fisheries station at Leadville, Colorado. About 30,000 fry were hatched at Verdi and liberated in the waters of the State of Nevada.

In 1905 the station was discontinued, the Truckee River continuing at such a height that the capture of spawning fish was not feasible with the equipment at hand. The funds of the commission would not allow a permanent barrier or trap; at least, the number of eggs collected did not justify the expense at that time. The hatchery supplies were sent to the stations on Lake Tahoe and at Sisson; the hatching troughs and other material too heavy to transport were donated to the State of Nevada, and have done some excellent service.

HORNBROOK EGG-COLLECTING STATION.

After a favorable report on the possibilities of taking rainbow trout spawn from Cottonwood Creek, Siskiyou County, had been made by W. H. Shebley, superintendent of Sisson Hatchery, in 1900, the board secured permission from Mr. David Horn, who owned the land on both sides of the creek, to trap the fish on his land and to make the necessary preparations to that end by constructing a temporary egg-collecting station. Accordingly, in January, 1901, operations were commenced by putting in a rack and large trap, also fitting up troughs in a tent for the purpose of eyeing the eggs before shipment to Sisson. It was found later, however, that the water supply taken from a spring, to be used for eyeing the eggs, was alkaline in character. Therefore operations for collecting eggs were carried on, and as fast as taken they were shipped direct to Sisson to be eyed and hatched. This proved to be both successful and economical, as the station required then only the services of one man to watch the traps, collect the spawn fish, and place them in a "live-box." Notwithstanding the fact that the trap was twice washed out by high water, 417,000 eggs were collected the first season. This was not considered a fair test of the capacity of the stream, as the storms were unusually severe and a warm rain on the deep snowfall caused freshets.

Operations were continued in the spring of 1902, and a new trap was put in in February, but the first run was lost because of floods which washed out the trap and allowed the fish to pass on up the stream. In spite of these drawbacks, 686,000 eggs were taken by the last of May. The cost of collecting the eggs being so slight, it was considered that the efforts and money had been well expended and that it would be advisable to continue to operate the station. The station was operated for several years by the California Fish and Game Commission and was then turned over to the United States Bureau of Fisheries, which continued operations until 1919, when the station was again returned to this department.

A careful investigation of Cottonwood Creek with reference to the collecting of rainbow trout eggs was made during the spring and early summer of 1919, with the result that a lease for a new site was obtained from Mr. Marshall Horn and a permanent system of racks was installed therein to trap the spawning trout as they ascend the stream. A new and larger holding-tank for the fish was also installed, and with the new equipment it was possible to obtain 1,600,000 trout eggs in the spring of 1920.

SALMON EGG-COLLECTING EXPERIMENTS ON EEL RIVER.

The commercial fishing at the mouth of the Eel River and the spearing of the breeding salmon on the riffles on the upper reaches of the river necessitated the propagation of salmon in larger numbers on Eel River. Experimental work was carried on at an experimental station on Bull Creek, one of the tributaries of the South Fork of the Eel

River, and also in the main river near the mouth. The results of these experiments of the last three years have not justified the expense of establishing a permanent egg-collecting station on the lower reaches of the river.

There are several conditions in that region that make it seem impracticable to establish an egg-collecting station there. The salmon, upon entering the mouth of the river, are compelled to remain in the large pond below Loleta until the river rises in the fall, as there is not enough water during the seasons of normal rainfall to allow the fish to pass over the wide, shallow riffles connecting the large pools from South Fork to the large pool at the mouth of the river.

As a rule the river rises to a considerable extent, but not before the majority of the salmon are caught by the commercial fishermen at the mouth of the river in the large pool. It has been suggested that eggs be collected from the fish in the large pool during the early fall before they ascend the river or are taken by the commercial fishermen, but we find that the fish do not ripen in numbers great enough to justify the expense of seining them up and separating the few ripe ones from those that are green or immature. Furthermore, there is no water near the mouth of the river suitable for hatchery purposes. If eggs could be taken in sufficient quantities to justify the expense of collecting them, they would have to be taken direct to Fort Seward Hatchery on the railroad, some sixty miles up the river. The eggs collected would, in all probability, be in such small lots that it would not pay to keep the necessary help and equipment.

Any attempt to place racks across the main Eel River or the South Fork, anywhere near its mouth, is almost impossible, as the loose nature of the formation is not solid enough to hold the racks and, even if this were overcome, the tremendous amount of water that comes down Eel River during flood periods, carrying logs and debris of all kinds, would make it impossible to retain any kind of a rack in the river. Furthermore, if a rack could be built that would stand the flood water of the river when the salmon were running, the number of fish that would be entering the river would be all fresh run from the ocean and would have to be held too long in order to allow them to mature.

An egg-collecting station on Eel River or its tributaries must be situated far up the stream, away from the tremendous floods and the floatage matter in the river, and must be in the upper reaches near the spawning grounds, where the fish have spent the necessary time in fresh water for the breeders to mature.

It takes less fry to stock Eel River and maintain the run of salmon than any other river on the coast, as there are few natural enemies of the young of the salmon to be found in the river. There are no predatory fishes, no diverting canals to carry off the water where fry are lost, or overflow basins, and very few water snakes or other natural enemies. If only a few million eggs can be collected and the resulting fry planted each season, the run of salmon in Eel River can be easily maintained provided the fishing at the mouth of the river is regulated as well as the ocean fishing, where large numbers of salmon are taken each season.

EEL RIVER EGG-COLLECTING STATION.

Extensive egg-collecting equipment was installed during the fall of 1921 on the South Fork of Eel River, near Branscomb. Racks, traps, holding pens and cabins for the assistants have been put in on the South Fork of Eel River. Racks and traps have also been placed in Charlie Creek, and on Kinney Creek an eyeing station has been put in and racks, traps, pens, etc., installed. The station has been equipped for extensive operations, and it is the intention to collect the eggs of the steelhead trout as well as those of the salmon.

BROOKDALE HATCHERY.

In 1905 Mr. F. A. Shebley located a hatchery at Brookdale for the county of Santa Cruz, on a tributary of the San Lorenzo River, twelve miles from the city of Santa Cruz. It has proved to be one of the best steelhead hatcheries on the coast, and the increased number of steelhead trout in the streams of Santa Cruz County is sufficient evidence of the success of this station. An auxiliary of the Brookdale Hatchery was established on Scott Creek, and it has been jointly operated by the California Fish Commission and Santa Cruz County. The fry hatched from the eggs collected at this station are distributed in the waters of Santa Cruz, San Mateo, Santa Clara and Monterey counties, and some of the eggs are shipped to Sisson and Eel River hatcheries for distribution in other localities. Beginning with July 1, 1912, both Brookdale Hatchery and Scott Creek spawning station have been operated exclusively by the state and a general distribution made of the product.

EDGEWOOD EGG-COLLECTING STATION.

After the abandonment of the station at Verdi, the commission still considered it wise to establish a station on some stream where a supply of rainbow eggs could be collected at small cost. Superintendent W. H. Shebley of Sisson was sent to examine the different streams in Siskiyou County for that purpose. He selected a point on the Shasta River near Edgewood, Siskiyou County. The cost of operating was light and, besides, the eggs could be transported direct from the spawning station to the Sisson Hatchery, avoiding the expense of a double crew of men.

The station was operated for the first time in 1906, but owing to unusual freshets which swept over the racks, most of the spawning fish were able to pass them, so that only about 50,000 eggs were taken. This, however, was considered sufficient to demonstrate the value of the station. An agreement was entered into with the Federal Bureau of Fisheries, which desired to establish a rainbow egg-collecting station, whereby the federal bureau was to bear part of the expense of operation of the station and was to receive in exchange the privilege of eyeing their eggs in the Sisson Hatchery. This arrangement was considered mutually beneficial to both commissions, and it tended to insure a continuance of the harmonious relations that existed between the two.

THE SACRAMENTO EXPERIMENTAL STATION.

During the fall of 1911 the commission decided to carry on a series of experiments to determine whether the eggs of the quinnat salmon could be successfully hatched and the fry reared near the city of Sacramento. It was thought that if water could be found in which the eggs could be hatched without causing injury to the eggs and embryos, a greater percentage of the fry would safely reach the ocean than would be the case if they were all liberated in the upper reaches of the river near the natural spawning grounds. It was maintained that under the old system of liberating the fry as soon as they were able to swim, a great many of them were devoured by predatory fishes, and others were carried into the overflow basins during years of flood.

Accordingly the station at Sacramento was established. Mr. F. A. Shebley conducted the work in addition to his duties as superintendent of the Brookdale Hatchery. The experiments as carried on at Sacramento were of vital importance to the salmon industry. After experimenting with the water from a number of wells, a flow of water was found on the Sherburn tract that appeared to be pure enough for salmon propagation. The fish hatched at this station were all released in the Sacramento River. Of these, 50,000 were marked in order to determine by careful observation whether a greater percentage return as mature salmon than those that were released on the upper reaches of the Sacramento River.

Nearly all of the fry that were liberated in the Sacramento River were floated in a screen cage by boat into the middle of the stream and there released. Mr. N. B. Scofield, however, took 500 in a floating box down the river, where they were held and fed for several weeks in brackish and salt water. They were not affected by the sudden change from the fresh to brackish and then to the saline waters of the straits near the outlet of the bay.

In the course of the experiments and in the search for suitable water for hatching purposes, two wells were bored and the water from other wells was also analyzed and experimented with. The batteries or series of troughs used in these experiments were set up in the open air near the wells, and the pumping plants were installed temporarily. The best results were obtained from the well on the Sherburn tract. Here a battery of 40 troughs was set up on the levee, and the pumping plant installed in a small building of corrugated iron. These experiments were continued until the season of 1912–1913, but with no favorable results. The water did not have the life-sustaining qualities of mountain stream water, although a well arranged system of aeration was used, and the conclusion was reached that the well water all through the valley contains too much mineral to hatch salmon eggs without destroying or injuring them so badly that they will not thrive if they should hatch out. The undertaking was accordingly abandoned in 1913, the station was closed and the troughs and other apparatus were shipped to the Sisson Hatchery.

BEAR LAKE HATCHERY.

With the aid of the San Bernardino Trout Association, San Bernardino County in 1914 built a trout hatchery with a capacity of 1,000,000 fish. The hatchery was located on the south side of Bear Lake. It was built under the supervision of Mr. E. W. Hunt, superintendent of the Tahoe Hatchery. The expense of the hatchery was borne by the members of the county association, and no money was solicited outside the county. The board of county supervisors had charge of the distribution of the fish hatched and were able to see to it that the local streams were well stocked with the output.

The object of this hatchery was to propagate rainbow trout from the fish in Bear Valley Lake. Bear Valley Lake (locally known as Big Bear Lake) is a body of water seven miles long and one and a half miles wide at its widest part. It is an artificial storage lake lying in the heart of the San Bernardino Mountains, about thirty miles from San Bernardino, at an elevation of about 7000 feet. This lake was stocked previously with rainbow fry from the state hatcheries, and these fish thrived remarkably. The association did not make a success of the hatchery and turned it over to the Fish and Game Commission.

In 1919 the necessity of increasing the capacity of the Bear Lake hatchery at Green Spot Springs became apparent, the old buildings that had been erected by the Southern California Trout Association being found inadequate. After procuring a permit from the forest service for a site adjacent to the site leased from San Bernardino County, a new hatchery with modern troughs was erected and fully equipped for the hatching and rearing of trout fry. The site at Green Spot Springs is about twelve miles from the egg-collecting station at North Creek. This is the only water available for hatchery purposes near Bear Lake. All the creeks dry up as the summer advances, except some small springs used for domestic purposes.

The Green Spot Springs rise near the foot of Sugar Loaf Mountain and flow through a shallow ravine toward Baldwin Lake. The water is used by the Shay Brothers on their stock ranch, after it leaves the hatchery. There is approximately 20 inches of water in the spring. It is cool and free from any organic substances, and is excellent hatchery water.

During the summer and fall of 1919, general improvements at North Creek Egg-collecting Station were made, and a new hatchery at Green Spot Springs with a capacity of 1,500,000 fry was erected. The work was begun early in September, but owing to delays in getting materials was not finished until late in November. At the hatchery at North Creek Egg-collecting Station, a portion of the eggs are hatched each season and the fry held until they are swimming well; then they are distributed in the most favorable places in Bear Lake, where there is an abundance of natural food. The fry can not be held in North Creek station later than the middle of July, as the water in North Creek fails by that time. The remainder of the fry reared for Bear Lake are held in the hatchery at Green Spot Springs until later in the season, when they are distributed in the lake in the shallows and other favorable spots.

During 1919 plans were made to build suitable quarters for the help at North Creek Egg-collecting Station, a cabin and a new trap on Metcalf Creek, and a cabin and a trap on Grout Creek. A new trap was built in North Creek, and the egg-collecting station and hatchery were repaired and improved.

The principal streams entering Bear Lake—North Creek, Metcalf Creek, Butler Creek and Grout Creek—were filled with sand from the high-water mark on the lake shore to the water's edge, averaging in length from one-fourth to one-half mile. The creeks are all short, but carry a large amount of granitic sand caused by the disintegrated granite formation through which these streams flow. These creeks had been filling up for several years, until in the spring of 1919 it was almost impossible for the breeding trout to enter them, as the water was spread over such a wide area of sand deposits that the fish could not find water of sufficient depth for them to swim in. In order to open these channels so that the fish could enter the streams and reach the traps, teams and scrapers were hired and the channels excavated through the sand deposits so that the water would have sufficient depth at the mouth of the creeks. The spawning area above the traps is so small that it does not justify allowing any of the fish to spawn naturally. The streams nearly all dry up before the eggs are hatched, even if they are allowed to ascend the streams and deposit their eggs. The majority of the eggs deposited by the breeders below the traps do not hatch, as they are covered over with the sand that packs so tight over the eggs that they are smothered. Consequently the stock of fish in Bear Lake must be kept up by artificial propagation almost entirely.

Years ago, when the lake was first stocked, the sand deposits were not so great, as the flood waters scoured the streams out each season; but during the last five or six years the sand has accumulated to such an extent that the creeks must be kept open by removing the sand every two or three years so that the fish can reach the traps.

Bear Lake has an abundance of natural feed for the trout. Besides the minnows there are a great many varieties of aquatic insects that abound in the lake in great numbers. During the last three seasons of drought these insects have increased, so that it is safe to say that there is not another body of water of equal size anywhere that has the same amount of natural food for trout.

SNOW MOUNTAIN EGG-COLLECTING STATION.

The Snow Mountain Egg-collecting Station was established in 1907. Early in the season of 1915 the commission secured a lease on the Cape Horn dam from the Snow Mountain Water and Power Company for one year, with the option of an additional five years. This lease gave the commission the use of the grounds and buildings, as well as the privilege of constructing tanks, traps, etc., on the land described in the Snow Mountain Egg-collecting Station lease. The dam that makes it possible to collect the fish is located on the south fork of Eel River, about twenty-five miles from Ukiah, Mendocino County. All the steelhead trout that ascend this branch of Eel River are easily trapped in the fishway over the dam. A small battery of hatching troughs was installed and holding pens for the spawning fish were provided. As the fish ascend the fish ladder they are automatically trapped and swim directly into the holding pens, from which they can not escape. It is a very cleverly arranged scheme, and in addition to being a saving by eliminating a great deal of work, lessens the loss of fish from handling. Snow Mountain station is one of the best steelhead egg-collecting stations on the coast.

FORT SEWARD HATCHERY.

Owing to the undesirable location of the Price Creek Hatchery, it was decided to remove it to a more favorable site. Price Creek Hatchery was located on Price Creek, one-half mile from its junction with Eel River. The creek has its source in the hills near the mouth of Eel River. The country through which it flows is a loose, friable and disorganized formation that is constantly sliding and washing away. During the winter months the creek was so full of sediment that it was only with the greatest skill and care that fish could be reared at all. In the spring the water dried up rapidly and became very warm, so that it was impossible to hold the fry later than June. The commission decided, therefore, to remove the hatchery to a more favorable location. The Department of Fishculture was instructed to select a suitable site and to move the station. After a careful survey of the streams on the line of the Northwestern Pacific Railroad, Fort Seward Creek was selected, a cold, clear stream, flowing into Eel River and about four and one-half miles above old Fort Seward, Humboldt County. The commission purchased forty acres of land near the mouth of the creek and selected a site for the hatchery about one-quarter of a mile from the Northwestern Pacific Railroad.

Early in 1916 the work of moving the building and equipment to the new site on Fort Seward Creek was begun, being completed and ready for the spring hatch of eggs. A cottage for the superintendent and a cabin for the men were erected and finished in a rough way until more comfortable quarters could be arranged.

The hatchery building is situated near the creek in a narrow canyon and the superintendent's dwelling on an eminence overlooking the hatchery. As funds were limited at the time the hatchery was established, only a poorly constructed cabin could be built for the help besides the cottage for the superintendent. During the fall of 1919, two four-room cottages, of plain interior finish and shingled outside, were built, so that men with families could be employed.

The water in Fort Seward Creek is the only water suitable for hatchery purposes on the line of the Northwestern Pacific Railroad. There are several streams between South Fork station and Fortuna, but they all have their sources in the same sedimentary formation as Price Creek, where it was necessary to abandon the hatchery owing to the great amount of sediment carried in the water during the winter and spring, when the rainy season was at its height.

The fry produced at this hatchery are the best reared in any of the hatcheries located in the coast counties.

YUBA CITY SHAD HATCHERY.

Early in the season of 1916 the question of propagating shad was taken up by the Department of Fishculture. The heavy fishing for shad in the bays and in the Sacramento and San Joaquin rivers in previous years had caused noticeable falling off in the numbers of these fish, and to keep the supply up it was deemed necessary to resort to artificial propagation.

About the same time, a request was received from the Massachusetts and Connecticut fish and game commissions requesting the California commission to collect shad eggs from California waters and ship them to their hatcheries, as they were desirous of restocking the depleted waters of the Eastern states with shad. Shad were introduced into California from New England states by the California Fish Commission in 1871. They increased rapidly until a few years ago, and the Sacramento and San Joaquin rivers were fairly alive with them in the spring and summer, when the run of shad was at its height.

The excessive fishing and pollution of the Eastern rivers has caused the shad to become very scarce, and it was the desire of the Massachusetts and Connecticut commissions to restock their waters. It was decided to collect the shad eggs for the two commissions, as it was considered an opportune time to carry on experiments to locate the spawning places of shad, as well as to make experiments to determine whether shad culture could be carried on successfully in California and to determine whether the process of fertilizing the eggs and propagating the fry could be improved upon.

Consequently the commission decided to operate a shad hatchery on a small scale during 1916, to carry cut the experiments and to gather data in preparation for more extensive operations the following season. When operations were begun, in May, it was thought that all the eggs necessary for the shipments East, as well as for our experiments, could be collected by the latter part of May or early in June, but the season proved to be unfavorable and the work dragged along into July without sufficient eggs being obtained at one time to make a shipment East.

Fishing began on June 3 at Yuba City. The run was poor all through the season in the upper reaches of the rivers; nowhere near its size in former years. The light run of shad in the upper river was due to the very cold spring, cold water, and later to the high, roily water caused by the melting snow in the higher altitudes. During the season 1,421,000 shad eggs were collected and 872,000 fry hatched and successfully released in the Feather River. This work was under the immediate supervision of Superintendent G. H. Lambson of the Mount Shasta Hatchery.

BURNEY CREEK EGG-COLLECTING STATION.

In the spring of 1915 a lease was secured on a piece of land at the mouth of Burney Creek, a tributary of Pit River, Shasta County, for the purpose of collecting rainbow trout eggs. A rack was placed across the stream and the necessary live cars and pens were made to hold the fish that were expected to enter the creek. A tent and a few troughs under it with hatching equipment was set up and operations were begun. It was originally planned to eye the eggs and hatch them in the old Hat Creek Hatchery, seven miles from Burney Creek, if a sufficient number were taken; but early in May an eruption of Mount Lassen sent a tremendous flood of mud, water and sand down the Hat Creek Valley, destroying all the fish in the stream from its source to its confluence with the Pit River. This was one of the most serious destructions of fish life in recent years in California. Hat Creek rises in the southeastern part of Shasta County, in a lake at the foot of Mount Lassen, at an altitude of 7300 feet above sea level. It flows northerly into the Pit River, two miles northwest of Carbon, where the old Hat Creek Hatchery was located. It is thirty-eight miles in length. Its principal tributaries are Rising River, a short stream arising from large springs in the lava, and Lost Creek. Rising River is only two miles in length, but has an average flow of 380 second-feet of water. Hat Creek, before its confluence with Rising River at the town of Cassell, has an average flow of about 100 second-feet during the summer months. Hat Creek and its tributary, Rising River, were noted for the excellence of their rainbow trout. After the flood of mud and Sand from Mount Lassen, the only survivors in the valley were those that were in Rising River. The water was muddy all during the season of 1915, and during the following years continued so muddy that it was not considered practical to restock the stream. It will probably be several years before fish will again thrive in Hat Creek, as the shifting sand deposited by the volcano destroys all the insect life in the stream, as well as making it uninhabitable for trout.

The fish enter Burney Creek late in the summer, but the run is a protracted one, lasting from April to August. The fish are late in developing, and if the fry were reared in a higher altitude and the progeny spawned later each season, a fall-spawning rainbow trout could probably be developed. This might have some advantages over a spring-spawning fish, as such trout would be in fine condition for the anglers when the fishing season opens in the spring.

MARLETT-CARSON HATCHERY.

The supply of eastern brook trout fry was increased considerably in 1916 and 1917. The Nevada State Fish Commisison did not operate its hatcheries, and the California commission was able to secure the privilege of collecting eggs from Marlett Lake, Nevada. The Carson City Hatchery was taken over by the commission, and the eastern brook trout eggs collected from Marlett Lake were shipped to this hatchery, where they were eyed and prepared for shipment. At this station 690,000 eggs were collected. The second year but half the eggs taken were to go to California under the agreement entered into. The share shipped to the Mount Shasta Hatchery amounted to 200,000 eggs.

DOMINGO SPRINGS HATCHERY.

An experimental hatchery was established at Domingo Springs in 1916. Improvements were made during 1917, when the temporary plant was moved to Rice Creek, one of the main branches of the North Fork of the Feather River above Lake Almanor. A thorough test of the water and an investigation of the run of fish resulted in the establishment of a permanent egg-collecting station and hatchery at this place. Accordingly, during the summer and fall of 1919, a permanent building was erected and a substantial trap constructed, one-quarter of a mile below the falls, in Rice Creek. The site was procured from the United States Forest Service. This desirable station will furnish fry for the entire region surrounding the west side of Lake Almanor, as well as the lakes and streams in the Mount Lassen National Park and surrounding country.

ALMANOR HATCHERY.

Almanor Hatchery was established in 1916 at the Big Meadows dam of the Great Western Power Company on Lake Almanor. It produced 261,000 rainbow eggs in 1918 and 282,000 in 1919. The water supply fails too early in the summer to permit the hatching and rearing of fry at the station, and accordingly the eggs were transferred to Clear Creek or Domingo Springs hatcheries as soon as they were "eyed."

YOSEMITE EXPERIMENTAL STATION.

With the intention of keeping the streams of the Yosemite Valley adequately stocked with trout fry, the commission during the fall of 1917 made a survey of conditions obtaining in the valley with reference to the establishment of a hatchery. A suitable site was obtained for a fine hatchery near Happy Isles, and application was made to the Department of the Interior for a lease to the property required for operations. Every assurance was given by the Yosemite Park officials that the department would grant a suitable lease, and pending the outcome of negotiations for the same the commission took advantage of a temporary permit granted it to establish an experimental hatchery on the site, in order that it might be definitely determined as to the practicability of the location for the propagation of trout. Arrangements were made with the State Department of Engineering for the preparation of suitable plans for the permanent hatchery.

The experimental station was established during the fall and winter of 1918 and was opened up for operations in the spring of 1919. Four hundred thousand rainbow, black-spotted and steelhead trout eggs were shipped to the station, and the resulting fry were reared and planted in the streams and lakes of the Yosemite Valley with the cooperation of park officials. The fry produced were vigorous and healthy and attained an unusual size in the few months that they were reared in the hatchery.

The site was demonstrated as being satisfactory for hatchery purposes, but as it is against the policy of the state to erect permanent buildings on leased land it was decided at a meeting of the Board of Fish and Game Commissioners, held during the latter part of October, 1920, to abandon the project. All equipment was therefore removed from the site and transported by auto trucks to the Wawona Hatchery, where it has been used to equip that station for more extensive operations.

MOUNT WHITNEY HATCHERY.

On February 2, 1917, the Mount Whitney Hatchery, located on a forty-acre tract on Oak Creek near the town of Independence, Inyo County, was turned over to the Fish and Game Commission by the Department of Engineering, under whose supervision the hatchery was constructed. The building is a beautiful structure of granite and gabro, and the coloring of the rubble walls blends harmoniously into the background of giant peaks that form the west wall of the valley. The building contains offices, storerooms and a laboratory on the lower floor and living quarters for the help in the upper story of the structure. It is equipped with up-to-date plumbing. All the troughs have a separate water supply. The aerating system is on the latest and most modern lines. The waste pipes, catch basins and drains are all of concrete. As a matter of necessity the first season's output was comparatively small, but the 1,285,000 fish distributed in the waters of southern California, the lower San Joaquin Valley, Inyo and Mono counties, were an exceptionally fine lot of fish. The ample supply of pure water in Oak Creek, that gushes from the granite rocks of the basal slopes of the Whitney Range, has proved to be excellent for the propagation of trout. The fry advance very rapidly and are strong and vigorous. The distribution of the fish has been very satisfactory in every particular.

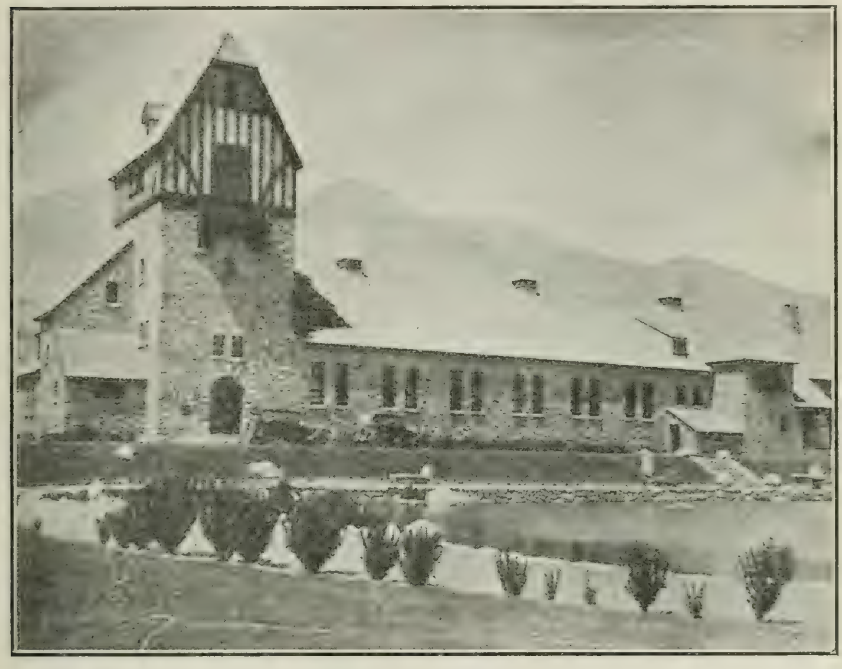


FIG. 38. Picturesquely situated at the eastern base of the Sierra in Inyo County, the Mount Whitney Hatchery is the best constructed and best equipped hatchery in the state.

The grounds around the hatchery have been ornamented and improved. A large pond has been constructed, in which there are a number of adult trout of different species. Surrounding the pond are extensive lawns and beautiful flower gardens, roadways, paths, etc. While it is true that the station is located at a considerable distance from some of the southern California and San Joaquin Valley sections, which receive their supply of trout therefrom, the transportation facilities are very good, the trains being run on schedules which permit of the fish being delivered to the applicants within a very short time after leaving the hatchery. Consequently the fry are in the very best possible condition when planted in the streams. While it may appear, to one not familiar with the existing conditions, that the distribution of the fish from Mount Whitney Hatchery is more expensive than from other stations on account of the high rate of fares from Mojave to Owenyo, the very reverse is true, for the trips of the distribution car are all comparatively short ones, enabling distribution work to be completed within a short time, which materially lessens the cost of distribution. But the most important feature of this hatchery is the excellence of the fry produced. They are truly wonderful fish, and the advantage to the southern waters resulting from the planting of such fry is inestimable.

The most interesting work undertaken at this station, from a fishcultural standpoint, has been the propagation of golden trout obtained from the Cottonwood Lakes station. The propagation of this species is very difficult, owing to the weakness of the embryos. The embryos hatched seem to lack vitality, and it is only by exercising the greatest care and patience in handling the eggs during incubation and in caring for the embryos, that the fry survive at all. However, golden trout are being successfully reared, and some very excellent results are expected from the stocking of the streams and lakes of the southern high Sierra, in which section conditions are propitious for the successful development of this species.

A supply of rainbow trout eggs is procured from the Rae Lakes, a system of lakes lying in the heart of the Sierra at an elevation of 10,500 feet above sea level.

RAE LAKES EGG-COLLECTING STATION.

The Rae Lakes Egg-collecting Station was established during the late spring of 1917 to furnish rainbow eggs for the Mount Whitney Hatchery. At the site of operations the altitude is 10,500 feet above sea level, located on a beautiful chain of lakes set in the heart of the high southern Sierra in Fresno County. The lakes are well stocked with rainbow trout. To reach the station in time to trap the fish as they enter the streams to spawn is extremely difficult. The trip into the lakes must be made via Oak Creek Pass, at an elevation of over 11,000 feet. There are few trails and the trip must be made through the blind mountain passes, over great depths of snow. Severe snow storms in this section, even in June, when the fish are spawning, are frequent. Even when the days are clear and warm the nights are freezing cold, and the journey through the passes is at best a difficult one, taxing the strength and resourcefulness of the hardiest mountaineers. Owing to the difficulties attending the opening up and operation of this station, and to the fact that sufficient skilled help to operate all the state hatcheries to capacity could not be obtained, this station was not utilized during 1918 and 1919. It was again operated in 1920 and 1921.

COTTONWOOD LAKES EGG-COLLECTING STATION.

During the summer of 1917, preliminary surveys were made of the Cottonwood Lakes country, Inyo County, to ascertain whether it would be feasible to undertake the propagation of golden trout.

The Cottonwood Lakes are situated in a rugged, almost inaccessible section of Inyo County near the Tulare County line, at the head of Cottonwood Creek. The lakes were stocked in the early seventies with golden trout from Mulkey Creek, a tributary of south fork of Kern River, and are now teeming with this most beautiful and gamey fish.

It was found that a number of creeks flowing into the lakes furnish excellent spawning grounds, and on what appeared to be the most favorable locations it was decided to put in racks and trap the fish as they ascended the streams to spawn. All arrangements were made to be on the ground at the proper time. All of the lumber, tools, tents, camp equipment and supplies had to be transported by pack train overland from Lone Pine. However, this was all successfully accomplished, and the men reached the site of the station in ample time to catch the first of the fish ascending the streams to spawn. Five hundred thousand eggs were taken and were successfully transported by pack animals from the spawning station to Mount Whitney Hatchery. The resulting fry were distributed in waters of that section.

The remoteness of the site of operations from railroads, highways or, indeed, any human habitations, the high altitude and prevalence of snow storms, make the trip into this remote section at this season of the year actually dangerous at times. Nevertheless the work has been continued, and crews have gone into the ''lakes'' each season and successfully accomplished their mission. The results obtained have justified all the hard work and expense. Although several efforts have been made in past years to collect the eggs of the golden trout, the attempt during 1918 was the first successful one. The success of the operations has been due to the skill and resourcefulness of Mr. George McCloud, who was in personal charge of the golden trout egg-collecting operations at Cottonwood Lakes and of Mount Whitney Hatchery, at which station the eggs were hatched and the fry reared. The golden trout are very difficult to rear, but the results obtained in this delicate work have exceeded expectations. The station was again operated in 1919 and 1920, but due to adverse weather conditions was not opened in 1921.

FEATHER RIVER EXPERIMENTAL HATCHERY.

During the spring of 1918, following out the plan of increasing the number of small hatcheries throughout the state, an experimental station was established in Plumas County, on the line of the Western Pacific Railway on a site on Grey Eagle Creek, about a mile from the town of Blairsden. Steelhead eggs were shipped to the station from Snow Mountain station, black-spotted eggs from Tallac Hatchery, and rainbow eggs from Domingo Springs station, the plan being to thoroughly try out this site in order that a permanent hatchery might be erected thereon should the water prove to be satisfactory for hatchery purposes. From this hatchery all of the trout fry for Plumas, Lassen and Modoc counties, along the line of the Western Pacific and the Nevada, California and Oregon railways could be hatched and distributed. With the inland territory in the Westwood, Lake Almanor and Juniper Lake districts covered by the Clear Creek and Domingo Springs hatcheries, and all railroad deliveries for the three counties above mentioned taken care of by the Feather River Hatchery (as the plant near Blairsden was to be named), all long hauls to this section from the Mount Shasta Hatchery could be eliminated. Unfortunately the water of Grey Eagle Creek did not prove satisfactory for hatchery purposes, and it became necessary to locate the hatchery in this section on some other creek. In 1921 the hatchery was moved to a site on Jamison

Creek, a tributary of Feather River. The station is located near Johnsville, in Plumas County. The operations last season were successful, and accordingly plans were made for the establishment of a permanent hatchery at this site.

CLEAR CREEK HATCHERY.

The Clear Creek Hatchery and Egg-collecting Station was established in the fall of 1918, on the creek that bears its name, one and one-half miles from the town of Westwood, Lassen County. Clear Creek is a tributary of the Hamilton branch of the Feather River, and a large portion of the spawning rainbow trout that ascend the Hamilton Branch of the Feather River enter this stream. As the source of Clear Creek is in a large spring, the water is pure and cold. The Red River Lumber Company furnished the site and material for the Clear Creek Hatchery, and the Fish and Game Commission furnished the labor for construction. Operations at this hatchery have been very satisfactory.

FALL CREEK HATCHERY.

In January, 1918, the California-Oregon Power Company began the construction of a concrete dam in the Klamath River two and a half miles above the mouth of Fall Creek in Siskiyou County. This dam, 110 feet high, has required a great deal of study on the part of the fishcultural department. The great problem involved was whether an efficient fishway could be constructed on such a dam, and if such a fishway were constructed, what would be the benefit derived from such an undertaking. The principal run of fish on the Klamath River in the region of the Copco dam is trout and salmon. The Federal Bureau of Fisheries has operated a salmon egg-collecting station on the river below the dam and have for the last eight years prevented the salmon from ascending the river above the racks at Hornbrook. This is necessary in order that the supply of salmon may be maintained in the Klamath River. If the racks were removed and the salmon allowed to ascend the river, and a fishway constructed that would allow the passage of the breeding salmon above the dam, the resulting fry would have to return to the ocean and on their downward journey would be destroyed by the power wheels of the hydroelectric plant that takes the water from the dam. Therefore the construction of a fishway for the passage of salmon above the Copco dam was not feasible. Accordingly, in compliance with the law, the Fall Creek Hatchery was constructed and paid for by the California-Oregon Power Company in lieu of constructing a fish ladder over the Copco dam in the Klamath River.

Under the provisions of the law passed by the legislature, whenever a dam or other obstruction is placed in a river or stream that, in the judgment of the Fish and Game Commission, is too high for the successful operation of a fishway, or for other reasons it is deemed best to establish a hatchery below the dam for the propagation of any species of fish that may be interfered with by the construction of the dam, the owners of the dam must construct and equip a hatchery for the purpose of propagating fish for the river and turn the hatchery over to the state for operation.

A site was selected on Fall Creek, a tributary of the Klamath River, at a distance of fourteen miles from the town of Hornbrook and along the line of the old Klamath River Railroad. A substantially constructed hatchery building, with a capacity of 100 hatching troughs, a cottage for the foreman and living quarters for assistants, comprise the equipment. The hatchery, completely equipped for fishcultural operations and with a capacity sufficient to adequately take care of requirements in that section, was completed and ready for operation in the spring of 1919. The Chinook salmon eggs, taken at the Klamathon Hatchery during the previous fall, were hatched here and the fry reared for distribution in the Klamath River and tributaries during the spring and summer of 1919.

A large portion of the rainbow trout eggs taken at the Bogus Creek station are immediately transferred to the Fall Creek Hatchery, where they are ''eyed,'' and later all surplus eggs over and above the amount required for stocking the Klamath River are shipped to other stations to be hatched and reared for general distribution. The racks and traps are located at Klamathon, where successful egg-collecting operations have been carried on by the California Fish and Game Commission and the United States Bureau of Fisheries for several years. The hatchery on Fall Creek is but twelve miles from the racks at Klamathon.

BOGUS AND CAMP CREEK EGG-COLLECTING STATIONS.

Since 1910, rainbow trout egg-collecting operations have been carried on in the Klamath River section by trapping the spawning fish as they ascend Bogus Creek and Camp Creek. The racks, traps and holding tanks in both of these creeks were in a very poor state of repair by 1919, and accordingly, in the fall of that year, the old egg-collecting plant was removed and new equipment installed. The success of operations after the new equipment was installed was very marked.

The spawning operations at these two creeks are carried on by the same crew, as they are but a short distance apart, Bogus Creek being on one side of the Klamath River and Camp Creek a short distance above on the opposite side of the stream. Accordingly the two camps are operated under the name of Bogus Creek station.

KLAMATHON HATCHERY.

In order that the run of Chinook salmon in the Klamath River might be properly maintained, it was deemed essential that the department increase the extent of its operations with reference to this locality.

For many years past the Klamath River has been stocked each season with Chinook or king salmon fry, the supply being principally obtained from eggs taken from the Sacramento River. The United States Bureau of Fisheries had operated the egg-collecting station at Klamathon, and the eggs here taken were mostly shipped to Sisson, where they were hatched, reared, shipped back and planted in the Klamath River. The bureau also hatched some fry at Klamathon, and these fry were planted early in the spring. However, the station was not well equipped for general operations, the water supply was poor and uncertain, and consequently the extent of the operations was limited and the results obtained were far from adequate. After a careful deliberation it was decided that some radical changes in the method of stocking the Klamath River must be undertaken. The matter was taken up with the Bureau of Fisheries and it very kindly agreed to turn the station over to the commission, donating also the use of most of the equipment, buildings, etc.

Construction of the racks, as a part of the Fall Creek Hatchery system, by the California-Oregon Power Company, was begun during the fall of 1918 and was finished in time to secure a small number of salmon eggs. Under the commission's plan of operation it was decided to take the eggs at Klamathon station and ship them to the new Fall Creek Hatchery, which was under construction at the same time, where they would be hatched, reared and planted in the Klamath River and tributaries. Nearly a million Chinook salmon eggs were secured during the fall of 1918, the first year of operation. During the fall of 1919 this station was prepared to operate at full capacity. Nearly 5,000,000 eggs were taken, despite the extreme drought, which materially affected the run of salmon in the Klamath River. The take of eggs has increased each year until, during the fall of 1921, a total of 19,000,000 eggs were procured. These eggs were all eyed at Mount Shasta and Fall Creek hatcheries, and the resulting fry were given the usual distribution.

KAWEAH HATCHERY.

Early in the spring of 1919 it was decided that to adequately stock the streams of Fresno, Tulare and a portion of Kern counties, a hatchery should be located in the most favorable situation in that district. Accordingly the proper investigations were made and a site located on the Kaweah River, near the town of Hammond, in Tulare County, chosen as the most favorable for the purpose.

The site is located on the property of the Mount Whitney Light and Power Company, on the main highway to the General Grant and Sequoia national parks, and has a water supply which is most excellent for hatchery purposes. It is the central distributing point for stocking the streams in that entire section. The location being all that could be asked for, an experimental station was established to determine the suitability of the water supply for fishcultural purposes. Three hundred thousand rainbow, 50.000 black-spotted and 100,000 steelhead trout eggs were hatched at the station during the spring. The resulting fry were reared to an advanced stage and were given a wide distribution in the streams of the Sequoia and General Grant national parks and the entire Kaweah River system during the months of August and September. The fry were strong and vigorous and at the time they were planted had attained an unusual size. It was demonstrated by the season's operations that the site selected was entirely satisfactory for the establishment of a permanent hatchery. The temporary hatchery has been operated each season, and will be until funds are available for putting up a permanent building.

SAN JOAQUIN EXPERIMENTAL SALMON HATCHERY.

The Kerckhoff dam, property of the San Joaquin Light and Power Company, that has recently been completed near Auberry's on the San

Joaquin, prevents the passage of the salmon to their former breeding grounds on the upper reaches of the river.

The Merced River will no longer afford a spawning ground for salmon, as a large irrigation project is planned that will hold back the flood waters of the Merced in a lake to be made by the construction of a high dam across the river near Exchequer. Plans had been made for the construction of fishways over the small dams in the Merced River, property of the San Joaquin Light and Power Company, and arrangements made for their construction, but the plan of the large irrigation reservoir makes it impracticable to attempt any further efforts to perpetuate the run of salmon in the Merced River. With the completion of the Kerckhoff dam and the proposed dam at Exchequer, the spawning grounds for salmon on the San Joaquin River and its tributaries are practically all cut off from the breeding salmon. During seasons of normal rainfall a few salmon will probably spawn near Friants, below power house No. 4 of the San Joaquin Light and Power Company. This area is very small and would not have any effect in keeping up the run of salmon in the river.

An experimental salmon-culture station was established on the San Joaquin River in 1921, with the object in view of determining what the expense would be of collecting the eggs near Friants in the fall and transporting them to the hatchery on Willow Creek, a distance of about thirty-five miles, hatching the eggs and rearing the fry in ponds, the fry to be held in the ponds until the following fall, then conveying them by auto truck to the river, below the Kerckhoff dam.

This plan proved impractical, owing to the inaccessible location of the site during the winter months and the great distance over rough roads which the green eggs would have to be carried in the fall. Plans are being made for the construction of a salmon-egg collecting station and hatchery on the San Joaquin River near Friants. This station will have to be constructed by the San Joaquin Light and Power Company, whose operations on the San Joaquin River have broken up the salmon run by the construction of high dams and the diversion of the water through a tunnel 17,000 feet long, through which the entire flow of the river passes during the summer months, leaving the bed of the San Joaquin River dry for a distance of twelve miles during the late summer and fall.

CONCLUSION.

This history should demonstrate that from small beginnings fishcultural operations have grown until California is a leader among the states in its output of trout and salmon. At the present time the state owns and operates thirty hatcheries and egg-collecting stations. Of this number, seven have been built within the last seven years. Each of the hatcheries is fully equipped and the largest one has a capacity of about 40,000,000 trout and salmon per year. Two railroad cars specially fitted for the transportation of the eggs and fry are maintained and operated to distribute the output. At several of the hatcheries auto trucks are utilized for short hauls to and from the railroad station, and in some cases for planting. In the maintenance of these hatcheries and egg-collecting stations, it is necessary to employ during the summer season nearly sixty men.

Had it not been for the stocking of barren streams, almost all of the rivers and creeks now furnishing good trout fishing would be devoid of fish. Name any of the prominent summer resorts, such as Big Bear Lake in southern California, Huntington Lake, Yosemite, The Pines, and you will find that previous to planting operations no trout fishing was to be had in the locality. The Bear Lakes, in San Bernardino County, as a result of planting now afford recreation and are a food supply to no less than 50,000 people annually, and improvements about the lake represent an investment of not less than $1,000,000.

Nine out of every ten persons summering at Bear Lake are interested mainly in the splendid trout fishing. The lakes and streams of Siskiyou and Shasta counties, of the Feather River region, of the Tahoe region, of the Yosemite region and of the upper regions of the San Joaquin, Kings and Kern rivers, teem with trout simply because the streams have been stocked. Several years ago the dams and lumber mills along the Truckee River destroyed the run of black-spotted trout in that stream. Had it not been for the introduction of other fish into this stream, anglers would now find few fish. However, eastern brook, Loch Leven and rainbow trout are now found in abundance in this stream—not native fish, but introduced species.

Not only have barren streams been stocked so that a new source of sport and food is available, but the supply has been maintained by constant planting. Depletion is to be noted wherever anglers are abundant, and were it not for restocking, the supply in many places would have failed long ere this.

Although the maintenance of California's hatcheries is costly, yet the output more than justifies the expense. The accompanying figures give some idea of the annual output and the consequent benefit to the people of this state:

Compared with the figures given for the output of Eastern hatcheries, it will be noticed that the number of fish reared is less. But it should be borne in mind that Eastern states deal largely with inferior fishes, producing large numbers of very small-sized eggs, whereas California rears trout and salmon which have large eggs. The general public does not sufficiently appreciate the accomplishments in this line of work. Even the applicants are so accustomed to having their requests for thousands and tens of thousands of trout fry met annually, and substantially as requested, that they little realize all the work and planning it takes to produce the fish, or the sum of money necessary to rear the millions of fish demanded.

Sections of the state in the most remote recesses of the high Sierra, which but a few years ago could be reached only by pack trains with the assistance of hardy mountain guides and days and often weeks of travel, are now reached in but a few hours from the main centers of population by automobiles, over some of the finest highways in the world. There can be but one result from such a condition of affairs, and that is the practical destruction of fishing in the majority of the waters of the state, unless the most stupendous efforts are put forth, and at once, to conserve our game fishery resources and to increase the

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Year of distr	Warmouth Bass *Chaenobryttus gulosus*	Black Bass *Micropterus sp.*	Calico Bass *Pomoxis sparoides*	Herring *Clupea pallasii*	Pike *Ptychocheilus oregonensis*	Total Distribution
1871						15,000
1872						103,005
1873						2,035,000
1874						5,750,866
1875						8,690,000
1876						7,599,000
1877						7,596,488
1878						14,303,898
1879						7,715,893
1880						8,121,550
1881						7,996,862
1882						4,000,881
1883						1,595,300
1884						239,832
1885						150 000
1886						1,300,000
1887						2,700,000
1888						1,941,000
1889						3,195,530
1890						3,272,417
1891	500					2,941,573
1892						3,474,655
1893						3,775,300
1894						12 247,265
1895	12					7,891,895
1896						19,513,436
1897						21,173,542
1898						35,903,988
1899						26,698,850
1900						6,263,000
1901						4,696,000
1902						16,268,310
1903						8,868,621
1904						102,155,475
1905						109,130,350
1906						89,639,935
1907						66,930,000
1908						60,395,000
1909						42,390,395
1910						35,297,806
1911						31,617,786
1912						37,060,799
1913						24,791,799
1914						36,872,501
1915						52,519,445
1916		2,684				36,434,839
1917		2,736				25,701,272
1918		1.250		12	12	30,033,760
1919		183	733			30,842,094
1920		378	555			25,693,633
1921						33,319,720
Total	512	7,231	1,288	12	12	1,128,865,566

ng stations

ABSTRACT OF FISH D

BY CALIFORNIA FISH AND GA

1871 TO 1921 INCL

Year of distribution	SALMON				TROUT															
	Quinnat *Oncorhynchus tchawytscha*	Atlantic *Salmo salar*	Land-Locked *Salmo sebago*	Silver *Oncorhynchus kisutch*	Rainbow *Salmo irideus*	Cutthroat *Salmo henshawi*	Large Lake *Salmo tahoensis*	Eastern Brook *Salvelinus fontinalis*	Dolly Varden *Salvelinus malma*	Loch Leven *Salmo trutta levenensis*	Mackinaw *Cristivomer namaycush*	German Brown *Salmo fario*	Steelhead *Salmo gairdneri*	Golden *Salmo roosevelti*	Shad *Alosa sapidissima*	Whitefish *Coregonus clupeiformis*	Striped Bass *Roccus lineatus*	Catfish *Ameiurus nebulosus*	Carp *Cyprinus carpio*	Small Mouth Black Bass *Micropterus dolomieu*
1871															15,000					
1872	50,000					22,000		6,000								25,000			5	
1873	2,000,000														35,000					
1874	5,750,000	305																144		85
1875	8,610,000							60,000								20,000				
1876	7,500 000														99,000					
1877	7,000,000				45,000			133.000							110,000	300,000		8,400	88	
1878	14,000,000		50,000		33.500			70,000							150,000				298	
1879	7,000,000				61,200	50,000										565,000	137	39 000	12	22
1880	7,500,000				32,000			41,500							250,000			10,050		
1881	7,500,000		20,100		23,600										220,000	230,500		2,662		
1882	4,000,000																300	500	71	
1883	1,000 000				95,000											500,000			300	
1884			25,000		214,000													500		
1885					150 000															
1886	1,200,000				100,000															
1887	200,000				2,000,000	500,000														
1888	1,290,000				50,000	601,000														
1889	2,168,000					1,027,000													30	500
1890	1,320,000				996,000	873,000		83,000											60	357
1891	2,798,250		30,000			88,000						14,478							60	
1892	2,651,000				506,500			317,000												155
1893	2,551,450				754,000	106,000		251,500												9,350
1894	7,776,400				1,080,240	2,983,950		266,000		20,000	100,000									20,675
1895	3,435,000				248,500	3,803,000		197,000	5,000	314	65,000	135,000								1,571
1896	15,283.183		250		434,000	3,668,650			2,000	1,697	300	105,000								16,752
1897	17,268,000					3,783,000		30		14,109	98,000	160								8,330
1898	31,458,388		700		667,000	3,417,900		85,000		260,000	7.000	6.000								
1899	22,214,000				275,000	3,827,350		5,000		246,000	47,500	76,000								
1900	2,536,000				883,000	2,385,500		6,000		312,000		136,000								
1901	3,239,000				862,500	95,000		8,000		307,500		184,000								
1902	14,782,540				847,500	630,000		6,000		1,500										
1903	7,209,621				497,000	747,000		415,000												
1904	100,000,000		5,000		515,000	750,000		768 200		10,000							60			
1905	105,000,000				790,000	2,393,500		640,000		215,000			86,000							
1906	87,318,495				1,042,500	125,000		794,550		303,900			4,000							
1907	63,697,000				2,003,000			826,000		268,000			135,000							
1908	54,465,000				3,440,000			1,780,000		540,000			170,000							
1909	32 843,945				3,083,500	4,115,000		1,220,000		955,000			168,000						100	
1910	22,500,000				5,325,000	4,000,000		1,000,000		1,484,000			986,800							
1911	23,111,000				2,810,600	2,729,751		497,500		607,550			1,858,100							
1912	18,909,445				6,166,676	8,913,670		931,300		1,293,500			794,458							
1913	16,277,227		7,835	25,000	2,121,718	2,273,520	87,149	843,350		1,132,500			1,983,500							
1914	25,290,615				898,000	4,837,000	143,500	1,025,000		1,567,000			3,110,583					115		
1915	33,313,150			1,517,000	3,501,000	3,124,000		854,000		1,626,500			8,582,500					121		
1916	19,339,738				3,399,920	3,835,270		2,068,500		1,620,000		77,300	5,213,170		872,000		5,500	200		
1917	6,853,000				5,223,500	3,836,000		1,617,500		1,468,000			6,699,420					676		
1918	14,439,000				5,680,500	1,059,500		2,294,500		1,633,000			4,483,000	384,000				53,927	15	
1919	12,326,200				7,063,500	1,670,700		1,171,500		2,882,700		320,000	4,718,100	684,650			3,500	38		
1920	8,644,000				7,476,500	758,000		1,228,000		4,290,800		1,117,000	1,859,000	319,000				160		
1921	9,393,000				10,182,000	520,000	988,000	1,709,000		4,717,000		1,218,000	4,592,000							
Total	865,014,647	305	138,885	1,542,000	81,578,454	73,549,261	1,218,649	23,218,930	7,000	27,777,570	317,800	3,388,938	45,443,631	1,387,650	1,751,000	1,640,500	9,497	116,493	1,039	57,797

FISH DISTRIBUTION

ISH AND GAME COMMISSION

O 1921 INCLUSIVE

Carp	Small Mouth Black Bass *Micropterus dolomieu*	Large Mouth Black Bass *Micropterus salmoides*	Pickerel *Esox lucius*	Yellow Perch *Perca flavescens*	Sacramento Perch *Archoplites interruptus*	Perch	Green Sunfish *Lepomis cyanellus*	Blue Gill *Lepomis pallidus*	Golden Shiner *Notemegonus crysoleucas*	Glass-eyed Perch *Stizostedion vitreum*	Eastern Lobster *Homarus americanus*	Silver Eel *Anguilla chrysypa*	Muskallunge *Esox masquinongy*	Tautog *Tautoga onitis*	Blue Crab *Callinectes hastatus*	Diamond-Back Terrapin *Malaclemmys palustris*	Crappie *Pomoxis annularis*	Grayling *Thymallus montanus*	Warmouth Bass *Chaenobryttus gulosus*	Black Bass *Micropterus sp.*	Calico Bass *Pomoxis sparoides*	Herring *Clupea pallasii*	Pike *Ptychocheilus oregonensis*	Total Distribution
																								[illegible]
5																								[illegible]
																								[illegible]
	85									16	4	12		300										[illegible]
																								[illegible]
																								[illegible]
88																								[illegible]
298																								[illegible]
12	22										22	500												[illegible]
																								[illegible]
																								[illegible]
71												10												[illegible]
300																								[illegible]
											332													[illegible]
																								[illegible]
																								[illegible]
																								[illegible]
																								[illegible]
30	500																							[illegible]
60	357																							[illegible]
60		2,610	400	6,980			10										285		500					[illegible]
	155																							[illegible]
	9,350												100,000											[illegible]
	20,675																							[illegible]
	1,571	1,450					48												12					[illegible]
	16,752	541	27	454			116		253		89			4		120								[illegible]
	8,330	955									271			525	162									[illegible]
									2,000															[illegible]
		8,000																						[illegible]
		4,500																						[illegible]
																								[illegible]
		620					150																	[illegible]
																								[illegible]
		6,215					1,000											100,000						[illegible]
		2,600					2,500		750															[illegible]
		7,490					4,000											40,000						[illegible]
							1,000																	[illegible]
																								[illegible]
100		4,850																						[illegible]
		2,006																						[illegible]
		3,285																						[illegible]
		1,750																50,000						[illegible]
																		40,000						[illegible]
		419		15			239	15																[illegible]
		359		800			15																	[illegible]
					358			164									35			2,684				[illegible]
						90		350												2,736				[illegible]
15						5,027	15	2												1,250		12	12	[illegible]
								80									210			183	733			[illegible]
								240												378	555			[illegible]
																	720							[illegible]
999	57,797	47,650	427	8,249	358	5,117	9,093	851	3,003	16	718	522	100,000	829	162	120	1,250	230,000	512	7,231	1,288	12	12	[illegible]

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extent of the operations of the fishcultural department. Every effort has been made to keep pace with the demands of the situation, but there is a limit set by the proportion of the financial income of the commission which can be devoted to fishculture.

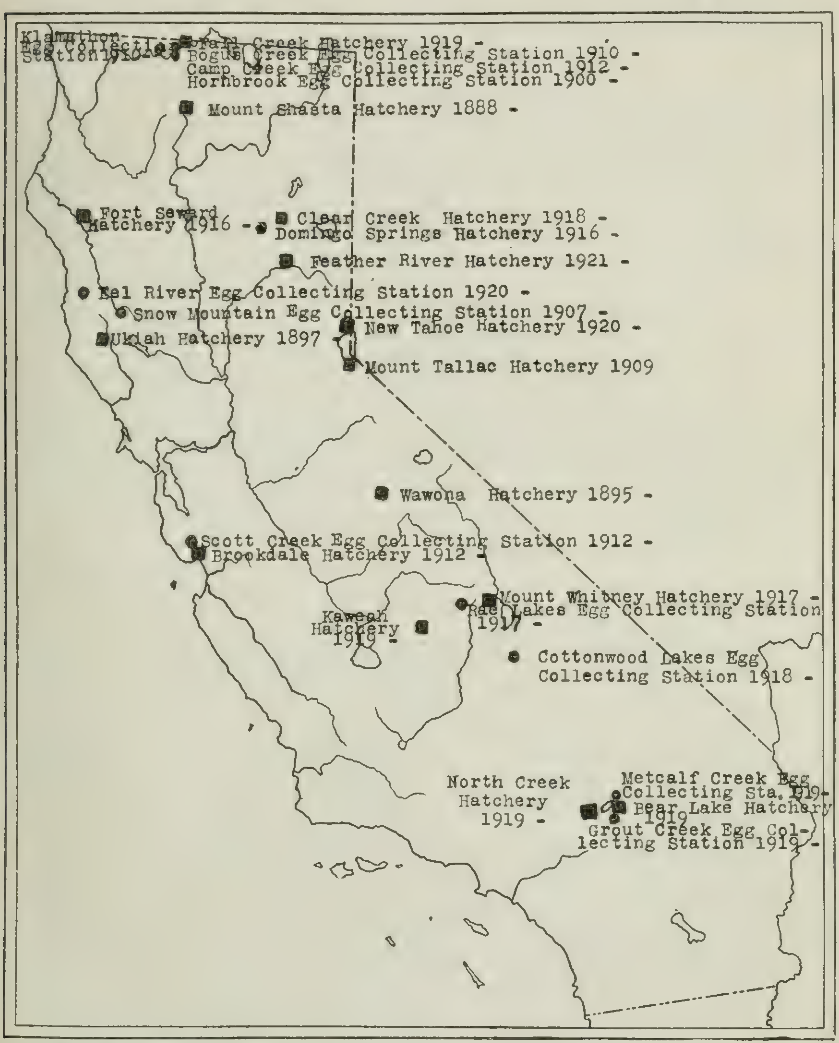
Klamathon Egg Collecting Station 1910 -
Fall Creek Hatchery 1919 -
Bogus Creek Egg Collecting Station 1910 -
Camp Creek Egg Collecting Station 1912 -
Hornbrook Egg Collecting Station 1900 -
Mount Shasta Hatchery 1888 -
Fort Seward Hatchery 1916 -
Clear Creek Hatchery 1918 -
Domingo Springs Hatchery 1916 -
Feather River Hatchery 1921 -
Eel River Egg Collecting Station 1920 -
Snow Mountain Egg Collecting Station 1907 -
New Tahoe Hatchery 1920 -
Ukiah Hatchery 1897 -
Mount Tallac Hatchery 1909
Wawona Hatchery 1895 -
Scott Creek Egg Collecting Station 1912 -
Brookdale Hatchery 1912 -
Mount Whitney Hatchery 1917 -
Rae Lakes Egg Collecting Station 1917 -
Kaweah Hatchery 1919 -
Cottonwood Lakes Egg Collecting Station 1918 -
North Creek Hatchery 1919 -
Metcalf Creek Egg Collecting Sta. 1919 -
Bear Lake Hatchery 1919
Grout Creek Egg Collecting Station 1919 -

FIG. 39. Map showing location of present hatcheries and egg-collecting stations and year established.

HATCHERIES AND EGG-COLLECTING STATIONS, 1870-1921.

Name	Location	Years of operation
Acclimatization Society Hatchery	City Hall, San Francisco	1870–1871
State Hatching House	University of California, Berkeley	1870–1877
Baird Fish Hatchery (U. S. Bureau of Fisheries)	McCloud River, Shasta County (Rebuilt)	1872– 1881–1883 1888–1920
Clear Creek Experimental Hatchery	Clear Creek, Lake County	1873–1874
Frazier Hatchery	Squaw Creek, Nevada County	1875–1880
San Leandro Hatchery	San Leandro, Alameda County	1878–1883
Hurley Hatchery	Tahoe City, Placer County	1880–1888
Woodson Egg Collecting Station	Fort Bidwell	1881–1884
Shebley Hatchery	Shebley's Station, Nevada County	1883–1888
Phipps Hatchery	Lake Tahoe, El Dorado County	1884–1888
Hat Creek Hatchery	Carbon, Shasta County	1885–1888
Mount Shasta Hatchery	Sisson, Siskiyou County	1888–
Tahoe Hatchery	Tahoe City, Placer County	1889–1891 1894–1920
Fort Gaston Fish Hatchery (U. S. Bureau of Fisheries)	Trinity River, Hoopa Indian Reservation, Humboldt County	1889–1898
Shovel Creek Egg Collecting Station	Klamath River, near Beswick, Siskiyou County	1889–1912
Glen Ellen Fish Hatchery (private hatchery controlled by state)	Glen Ellen, Sonoma County	1890–1891
Del Monte Fish Hatchery (private hatchery controlled by state)	Del Monte, Monterey County	1890–1891
Bear Valley Hatchery	Olema, Marin County	1891–1894
Alma Fish Hatchery (private hatchery controlled by state)	Alma, Santa Clara County	1892–1893
Korbel Fish Hatchery (U. S. Bureau of Fisheries)	Redwood Creek, Mad River, Humboldt Co.	1893–1897
Independence Lake Fish Hatchery and Egg Collecting Station	Independence Lake, Nevada County	1893–1894
Redwood Creek Egg Collecting Station (U. S. Bureau of Fisheries)	Redwood Creek, Humboldt County	1893–1897
Battle Creek Fish Hatchery	Battle Creek, Shasta County	1895–
Wawona Hatchery	Wawona, Mariposa County	1895–
Mount Tallac Hatchery	Taylor Creek, El Dorado County	1895–1909
Price Creek Hatchery	Price Creek, Grizzly Bluff, Humboldt Co.	1897–1916
Ukiah Hatchery	Ukiah, Mendocino County	1897–
Mears Creek Egg Collecting Station	Near Sims, Shasta County	1898–1899
Hazel Creek Egg Collecting Station	Near Sims, Shasta County	1898–1899
Hornbrook Egg Collecting Station	Cottonwood Creek, Siskiyou County	1900–
Campbell Creek	McCloud River, Shasta County	1901
Squaw Creek	McCloud River, Shasta County	1901
Howe Creek Egg Collecting Station	Eel River, Humboldt County	1902
Mill Creek Hatchery (U. S. Bureau of Fisheries operated by state)	Los Molinos, Tehama County	1902–
California State Verdi Fish Hatchery	Verdi, Nevada State	1902–1905
Edgewood Experimental Station	Upper Shasta River, Siskiyou County	1906–1907
Snow Mountain Egg Collecting Station	Eel River, Mendocino County	1907–
Shasta River Egg Collecting Station	Yreka, Siskiyou County	1907–1908
Bouldin Island Bass Hatchery (striped bass)	Bouldin Island, San Joaquin County	1907–1909
Glen Alpine Hatchery	Glen Alpine Springs, El Dorado County	1908–1913
Bogus Creek Egg Collecting Station	Klamath River, near Hornbrook, Siskiyou County	1910–
Klamathon Egg Collecting Station	Hornbrook, Siskiyou County	1910–
Sacramento Experimental Salmon Hatchery	Sacramento	1911–1913
Brookdale Hatchery (operated by county, 1905 to 1912)	Brookdale, Santa Cruz County (operated by state)	1912–
Scott Creek Egg Collecting Station (operated by county, 1905 to 1912)	Scott Creek, Santa Cruz County	1912–
Willow Creek Egg Collecting Station	Thrall, Siskiyou County	1912
Camp Creek Egg Collecting Station	Siskiyou County	1912–

HATCHERIES AND EGG-COLLECTING STATIONS, 1870-1921—Concluded.

Name	Location	Years of operation
Bear Lake Fish Hatchery	Big Bear Lake, San Bernardino County	1914–
Gottville Egg Collecting Station	Siskiyou County	1914
North Creek Egg Collecting Station	Big Bear Lake, San Bernardino County	1915–
Burney Creek Egg Collecting Station	Near Burney, Shasta Co., on Pit River	1915
Ward Canyon Egg Collecting Station	Copco, Siskiyou County	1915
Fort Seward Hatchery	Alderpoint, Humboldt County	1916–
Marlette-Carson Hatchery	Carson City, Nevada (operated by California Fish and Game Commission)	1916-1917
Almanor Fish Hatchery	Almanor Dam, Plumas County	1916-1919
Yuba City Experimental Shad Hatchery	Yuba City, Sutter County	1916
Domingo Springs Hatchery	Chester, Plumas County	1916–
Rae Lakes Egg Collecting Station	Rae Lakes, Fresno County	1917–
Bryan's Rest Egg Collecting Station	Bryan's Rest, Humboldt County	1917
Mount Whitney Hatchery	Independence, Inyo County	1917–
Yosemite Experimental Hatchery	Yosemite, Mariposa County	1918-1920
Cottonwood Lakes Egg Collecting Station	Cottonwood Lakes, Inyo County	1918
Clear Creek Hatchery	Westwood, Lassen County	1918–
Feather River Experimental Hatchery	Grey Eagle Creek, Plumas County	1918
North Creek Hatchery	Big Bear Lake, San Bernardino County	1919–
Fall Creek Hatchery	Copco, Siskiyou County	1919–
Kaweah Hatchery	Hammond on Kaweah River, Tulare Co.	1919–
Metcalf Creek Egg Collecting Station	Big Bear Lake, San Bernardino County	1919–
Bull Creek Egg Collecting Station	Dyerville, Humboldt County	1919
Grout Creek Egg Collecting Station	Big Bear Lake, San Bernardino County	1919–
Warner Creek Egg Collecting Station	Plumas County	1920
Eel River Egg Collecting Station	Branscomb, Mendocino County	1920–
New Tahoe Hatchery	Tahoe City, Placer County	1920–
Feather River Hatchery	Johnsville, Plumas County	1921–
San Joaquin Experimental Station	Auberry	1921

FISHCULTURAL DEPARTMENT PERSONNEL.

By Harold C. Bryant.

The fishcultural work of the state gained its initial impetus from the first commissioners, appointed in 1870, Messrs. B. B. Redding, S. R. Throckmorton and J. O. Farwell. Because of their interest in stocking the streams with desirable food fishes, the hatching and rearing of fish received due encouragement. The first fishculturist retained by the commission was Mr. J. G. Woodbury, who had been carrying on experiments in fish breeding for the California Acclimatization Society, and later for the United States Fish Commission. Mr. Woodbury devoted nearly twenty years of his life to the interests of fishculture in California. His principal work was done at Berkeley and San Leandro, where trout and salmon were reared, and at Clear Lake station, where the propagation of whitefish was attempted. Mr. Woodbury became first assistant to Dr. Livingston Stone at the time the government salmon-breeding station on the McCloud River was established in 1872. He was made State Superintendent of Hatcheries in 1888, and during the same year, with the assistance and advice of Dr. Livingston Stone and United States Commissioner Marshal McDonald, he located the Sisson Hatchery. The following year he located the hatchery at Tahoe City.

In 1891, desiring to engage in private business, Mr. J. G. Woodbury resigned as superintendent of hatcheries. In 1893, the board appointed Mr. John P. Babcock to fill the newly created position of chief deputy of the California Fish Commission, in which capacity Mr. Babcock acted from 1893 until 1901, when he resigned to accept a position with the government of British Columbia.

The successful transportation of eggs and fry from Eastern states in the seventies was due to Dr. Livingston Stone, a fishculturist of the United States Fish Commission. On each of the several difficult transcontinental trips Dr. Stone proved that he understood the care of fish. As much of acclimatization work was a cooperative project by the United States Fish Commission and the California Fish Commission, Dr. Stone was at times under the employ of the California commission. This was true also when he became superintendent of the McCloud River Hatchery, for the California commission bore a portion of the cost of hatching and planting the salmon.

Mr. J. A. Richardson, who had been employed by the United States commission at the Baird Hatchery, and who was an assistant at the San Leandro Hatchery, was made Superintendent of the Shebley Hatchery when it was built in 1883. Mr. Richardson resigned in the fall of the same year, and Mr. I. C. Frazier was appointed to succeed him. Mr. Frazier was a successful and competent fishculturist, who had been a student of fish life for a great many years. In the early seventies he associated himself with some of the acclimatization societies and later established a hatchery, with rearing ponds, on the Truckee River. In 1884, owing to ill health, he resigned as superintendent of the Shebley Hatchery, and Mr. J. V. Shebley was appointed superintendent. In 1885, Mr. J. V. Shebley was appointed Superintendent of Hatcheries, and Mr. W. H. Shebley succeeded him at the Shebley Hatchery. Mr. Frazier later became superintendent of the Tahoe Hatchery, and Mr. Richardson was again employed as an assistant.

When the Sisson Hatchery was built, in 1888, Mr. J. A. Richardson was appointed superintendent, and he managed the station until 1893, when Mr. W. H. Shebley succeeded him. The largest hatchery in California, and in some respects the largest in the United States, was for twenty-one years under the efficient supervision of Mr. W. H. Shebley. As superintendent he demonstrated that millions of trout could be successfully reared each year without serious loss.

The pioneer work of introducing the first shipments of trout in the barren waters of the Yosemite region was carried on by Mr. Shebley, who introduced the first fish in the waters above the valley in 1892.

In November, 1911, the commission created the office of fishculture and distribution, and Mr. Shebley was assigned to this new division of the work. A successful organization of this department was soon accomplished, with the division of screens and fishways, as part of the department of fishculture. As the duties of this work required Mr. Shebley to be away much of the time, Mr. R. W. Requa was made assistant superintendent of the Sisson Hatchery, and he very ably assisted in conducting the work of the station. Being a skilled mechanic, Mr. Requa invented and perfected the rotary type of screen used in irrigation ditches.

The success of early experiments and the efficiency of the present fishcultural department have been due largely to the untiring care and energy of Mr. W. H. Shebley. There is no one in America who possesses greater knowledge of fishcultural methods. Present fishcultural methods and the system of rearing ponds installed at the Mount Shasta Hatchery will always be a monument to his ingenuity.

On March 1, 1916, the office of the department of fishculture was transferred from Sisson to San Francisco. Extensive fishcultural operations demanded a more centrally located section. Mr. E. W. Hunt was appointed field superintendent of the department of fishculture, and Mr. J. H. Hoerl chief clerk. Mr. Shebley was succeeded as superintendent of the Sisson Hatchery by Captain G. H. Lambson, who for seventeen years was superintendent of the United States Bureau of Fisheries stations in California.

The hatcheries at Lake Tahoe were for twenty years under the supervision of Mr. E. W. Hunt, who is a fishculturist of long standing and a man of keen business ability. The results of his management are evident now in the well-stocked lakes and streams of the region. Since 1916 Mr. Hunt, as field superintendent, has done most of the inspection and advisory work at the various hatcheries.

The work at Ukiah was for many years very capably handled by Mr. A. V. La Motte.

For many years Mr. M. L. Cross had charge of the Wawona Hatchery and directed the distribution that has placed trout in hundreds of miles of streams and thousands of acres of lakes in the previously barren areas lying above and beyond the Yosemite Valley. As a hatchery man, his work was always above criticism.

For many years previous to his death in 1918, Mr. F. A. Shebley was a trusted fishculturist of the commission. He was the son of California's first famous fishculturist, and had succeeded before his death, in company with his brother, William H. Shebley, in making a reputation in the same line of endeavor as great, if not greater, than that of the father who had gone before. As a boy he followed farming on his father's place, but for twenty-five years he was identified exclusively with fishculture in connection with the California Fish and Game Commission, and there were few men on the Pacific slope who knew as much about fish and fishing in the waters of the rivers and bays as he. At various times he was superintendent of the Price Creek hatchery in Humboldt County and the Brookdale Hatchery in Santa Cruz County, and later the new Mount Whitney Hatchery in Inyo County. Under his management the Brookdale Hatchery became very popular and was sought out by sportsmen from all over California as a place of great interest. Also interested in angling as a sport, he was a master of the fly rod and a skilled angler.

In 1900 Mr. W. O. Fassett was appointed superintendent of Eel River Hatchery, and under his management the station was a continued success. In more recent years Mr. Fassett has had charge of all of the fishcultural operations along the north coast.

In October, 1901, Mr. Charles A. Vogelsang was appointed chief deputy of the California Fish and Game Commission, following the resignation of Mr. J. P. Babcock. During the administration of Mr. Vogelsang as executive officer of the commission (1901–1910) a number of practical improvements were put into effect; the Sisson and the Tahoe stations were enlarged and improved; the hunting license law was passed, which placed at the command of the commission an increased amount of funds that could be devoted to the propagation and protection of the fish and game; the fish-distributing car was built; the game farm was established, and other improvements were made. In the carrying out of all of this work Mr. Vogelsang took an active part. He resigned in 1910, but was reappointed executive officer in 1920 and held that position until March, 1922.

There have been many other faithful hatchery employees, but their years of service have been more limited.

THE RETURN OF MARKED KING SALMON GRILSE.

By J. O. SNYDER, Stanford University.

Twenty-three marked king salmon grilse were taken at the Klamathon racks last fall. This is the first result of a marking experiment initiated in 1918 by W. H. Shebley, in charge of fishculture. A complete account of the marking of these fish, as published in CALIFORNIA FISH AND GAME, July, 1920, may be summarized here. From king salmon eggs taken in Mill Creek, a tributary of the Sacramento River, in November, 1918, and hatched at Fall Greek Hatchery on Klamath River in February, 1919, 250,000 fish were placed in a rearing pond. In November, 1919, these were liberated in Klamath River, after 25,000 of them were marked by removing the adipose and right ventral fins (Fig. 40). It appears that the marking was successfully accomplished and that the fish were liberated under the best conditions. Some of these were expected to return as grilse in 1921, and later as older fish.

The marked fish appeared at Klamathon, where they were stopped by the racks, from October 24 to November 14, when the last one was taken. Of the last ones secured, Captain Lambson remarks, "Two were in very fine condition, as if lately from salt water." These fish measured from 15½ to 24½ inches to the end of the middle caudal rays. All were mature males.

Scales of these marked fish, together with mutilated fins, were carefully preserved by E. V. Cassell, foreman of the Fall Creek Hatchery. This material and a considerable amount of necessary data were assembled and forwarded to the writer by Captain G. H. Lambson. Therefore the record of each specimen is accurate and complete.

A photomicrograph of a scale of one of these grilse is here presented as figure 43. An examination of this scale will reveal some peculiarities of structure. It will be seen that a well-defined inner part or nucleus, A, is composed of 11 or 12 concentric rings or circuli, which are closely apposed and in some places broken or branched. Outside the nucleus and surrounding it is a broad area of more-regularly formed circuli, which are at the same time much wider. This area, which may be designated A-D in the figure, is bounded at D by a crowded condition of the circuli. Beyond this area is a third region, D-E, the circuli of

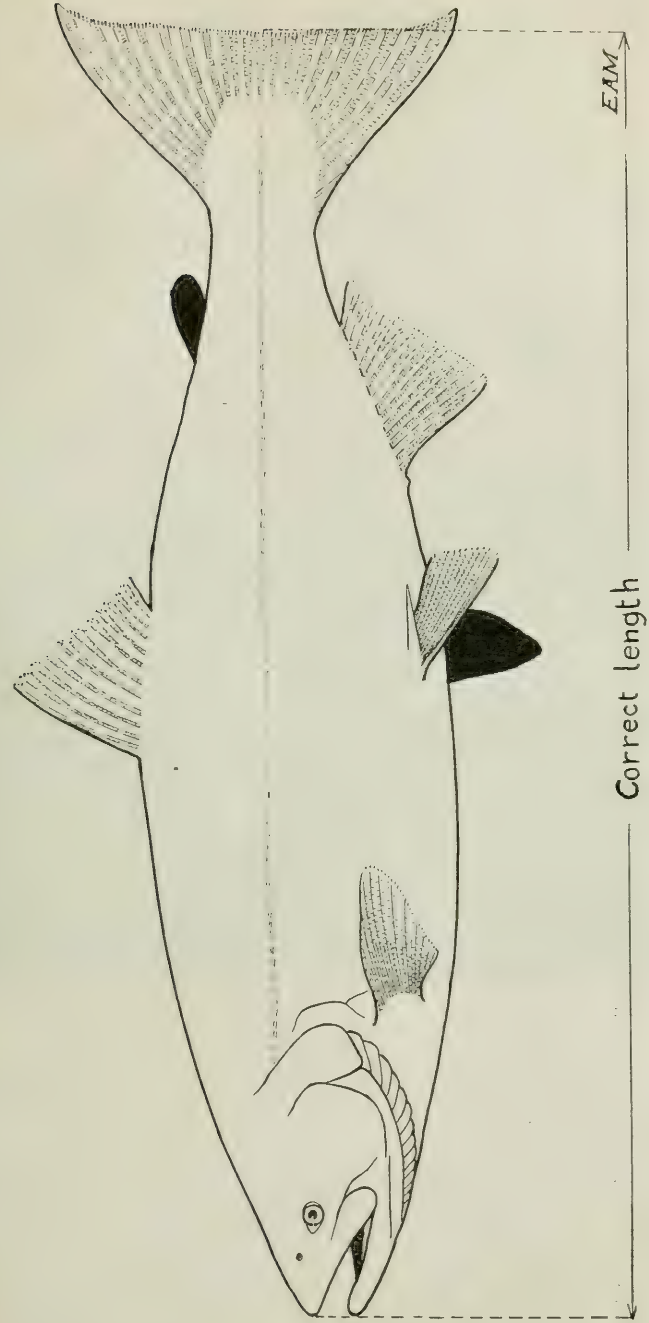

FIG. 40. Outline drawing of king salmon, showing method of marking in experiments by the removal of the adipose and the right ventral fins.

which are still wider than the others. This region extends to the edge of the scale, which is rough and broken. In the area marked A-D the circuli are not altogether homogeneous in character, for at B and also at C, two or three of them are closely apposed or narrower than the others. These are the principal structural features of this particular scale.

Scales from the other marked grilse possess very similar characteristics. These present the same type of nucleus, which is surrounded by two distinct outer areas, the inner of which is much like that of the scale just described. The nucleus, when followed through the entire series of 23 scales, is seen to possess the same closely crowded or narrow circuli, although they vary in number from 8 to 14. The area designated as A-D is in cases wider or narrower, but it preserves more or less definitely the same features. The outer area, D-E, varies greatly in width, in some cases being scarcely represented. The irregular edge and the variable width of this outer area are due to absorption which the scale has undergone, it having suffered as have some other tissues of the body during the long and difficult migration from the sea, which was performed without food. In grilse taken at the mouth of the river this portion of the scale is perfect, as is illustrated by figure 44.

FIG. 41. The racks at Klamathon, between which the returning grilse were trapped. Photograph by E. A. McGregor.

It will be of interest to attempt an interpretation of some of the structural features which are apparent in these scales, even in the face of the possibility that such interpretation may not be wholly supported by additional data which it is hoped the future will provide. In the first place, we know that the fish is in its third year, and by the application of the well-tested criteria of investigators of scale growth, it may be safely stated that the nucleus represents roughly the growth of the first year, the area A-D that of the second, and D-E the third, a part of the latter having been effaced by absorption.

The nuclear growth record as traced in these scales is exactly duplicated by that of scales removed from some small yearlings of the same lot at the time of their liberation. Such scales are represented by figure 46.

The nucleus of the scale represented by figure 43 is much like that of a naturally spawned fish which has spent its first year in the river. A scale that is believed to be of such an individual is represented by figure 44. This type of nucleus is very different from that of a salmon which entered the sea at an earlier period in its life, near the time that scales make their appearance. A scale of such a fish which was taken in its third year is shown in figure 43, where the first year's growth extends to A.

FIG. 42. Spawning operations at Klamathon. E. V. Cassell, taking eggs from a female king salmon. Photograph by E. A. McGregor.

Attention was directed to the lack of homogeneity in the area A-D, which is presumed to represent the growth history of the second year. Two very evident intermediate checks appear, one at B, the other and later one at C. The area enclosed by the check B is composed of circuli which are somewhat narrower than the others, possibly characteristic of slower growth. It might be presumed that this area is one of river growth, attained while the fish lingered in the estuary, where food abounds. It is not strictly characteristic of estuary growth, however, as illustrated by fish taken at or near the mouth of Klamath River. In the latter part of August, and probably much earlier, yearling salmon appear in the estuary, where they linger and grow very rapidly. Some specimens measuring 200 millimeters and looking much like miniature salmon from the sea were collected in September. A scale from one of these is shown in figure 47. In this scale a nucleus, A, is apparent, which is surrounded by an area of wider circuli. From facts learned from observation of these fish, this region is undoubtedly representative of estuary growth, and a comparison of this with the area A-B would scarcely lead to a similar interpretation for the latter. It seems more probable that after being liberated this fish hastened on his long journey to the sea, growing very little, if any, on the downward passage.

While in the sea during the second year, two checks in growth occurred, due to what cause we have no means of knowing. Near the end of the second year a check normally appears. This is represented at D. Abundant material from Monterey Bay shows that this check usually develops in the winter or early spring, not appearing in all individuals at the same time.

The intermediate checks offer nothing remarkable, as somewhat similar characters may be easily found in any large assemblage of king salmon scales. They might be passed over as indicating that some event in the life of the fish, temporary scarcity of food, for example, had served to interrupt or check its normal growth at a particular time. But in this they deserve further consideration, as will appear.

Of the twenty-three marked salmon which were recovered, no less than seventeen possessed scales which in every essential detail were like that illustrated in figure 43. That the nuclei should be much alike occasions no surprise, for all were reared alike, and consequently environmental conditions were similar for all while the nuclear growth progressed, but that this detailed resemblance should continue in such a marked way through the second year is worthy of attention.

Under an hypothesis that the growth of the fish is reflected by the growth of the scale, and that growth is influenced by environment, the assumption follows that all of these fish must have been in contact with the same environmental conditions during the second year. It would appear not at all improbable that they schooled together. This suggests the possibility that associations formed in the stream may continue in a large measure throughout life in the sea. The four-year fish of this marking, if any are caught, will furnish additional data of interest in this connection. They will also bring a record of the third year, which in these grilse is largely effaced.

Scales of the remaining marked fish differ in a minor degree only from the others by having a more or less well-defined check about half way between those marked B and C in figure 43.

As 250,000 fish were liberated, of which 25,000 were marked, the return of ten unmarked individuals with every marked one might be expected. Unfortunately, scales were preserved from very few unmarked grilse while the marked ones were being taken. However, among those that were preserved are two which show the same characteristic scale structure as the marked ones. A photomicrograph of one

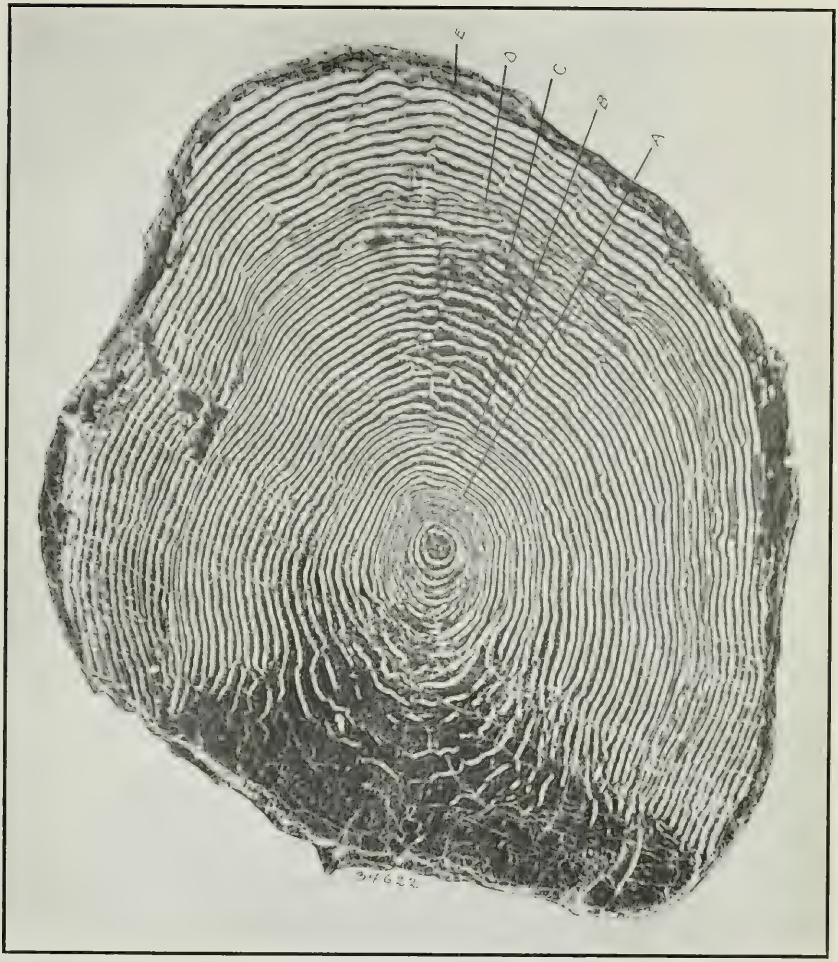

PLATE I.

FIG. 43. Photomicrograph of a scale of a marked king salmon grilse which returned to Klamathon racks in 1921.

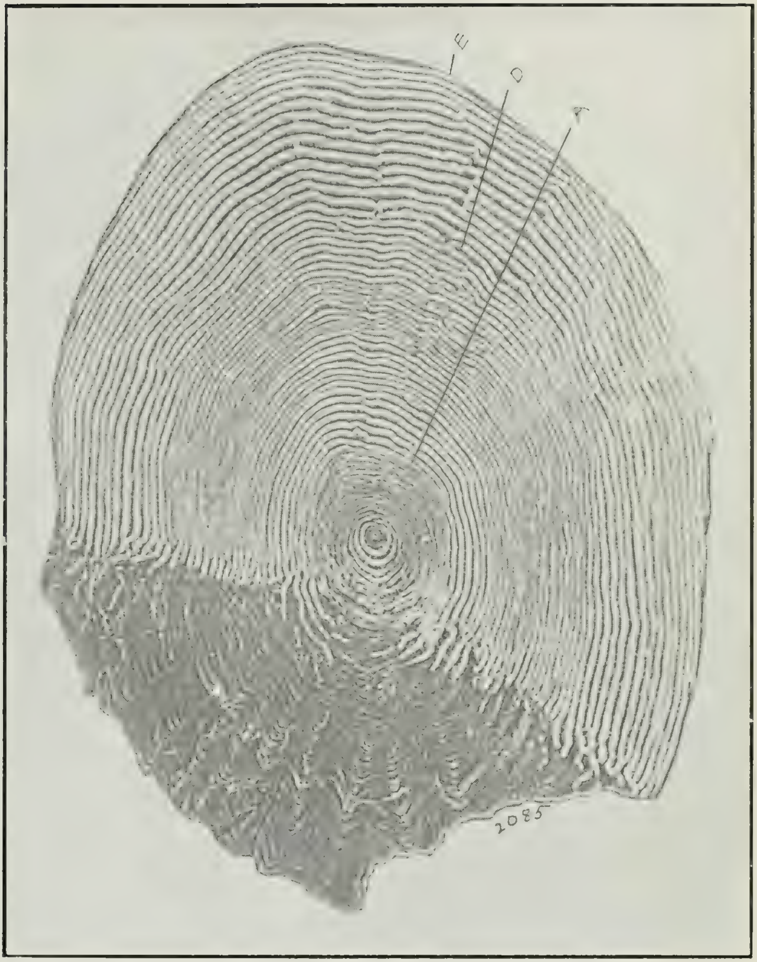

PLATE II.

FIG. 44. Scale of a male king salmon in third year. From Klamath Estuary.

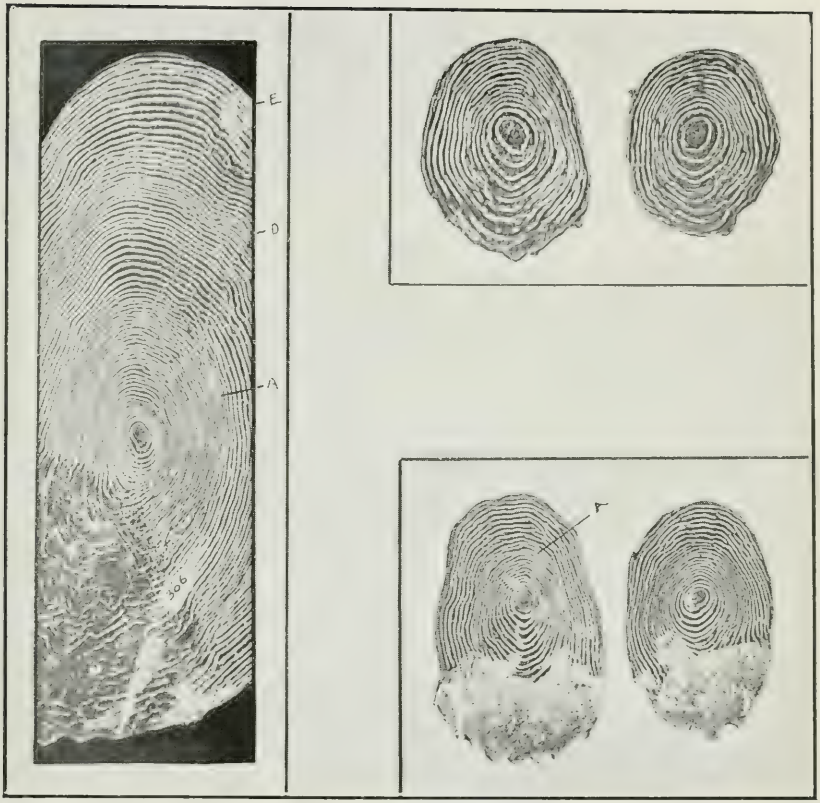

PLATE III.

FIG. 45. Scale of a male king salmon in third year; ocean type of nucleus.

FIG. 46. Scale of a yearling king salmon 84 millimeters long. One of a marked lot of fish which was preserved at the time the others were liberated.

FIG. 47. Scale of a yearling king salmon measuring 200 millimeters, showing estuary growth.

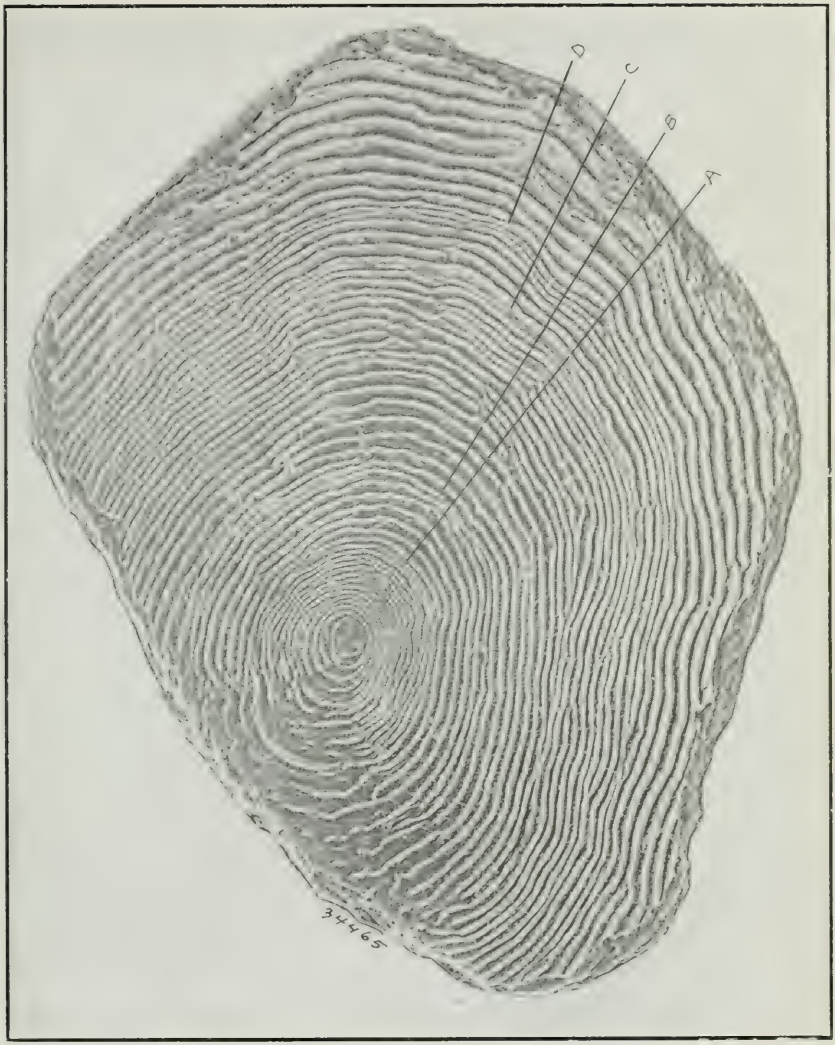

PLATE IV.

FIG. 48. Scale of an unmarked grilse which was liberated with marked ones in Klamath River.

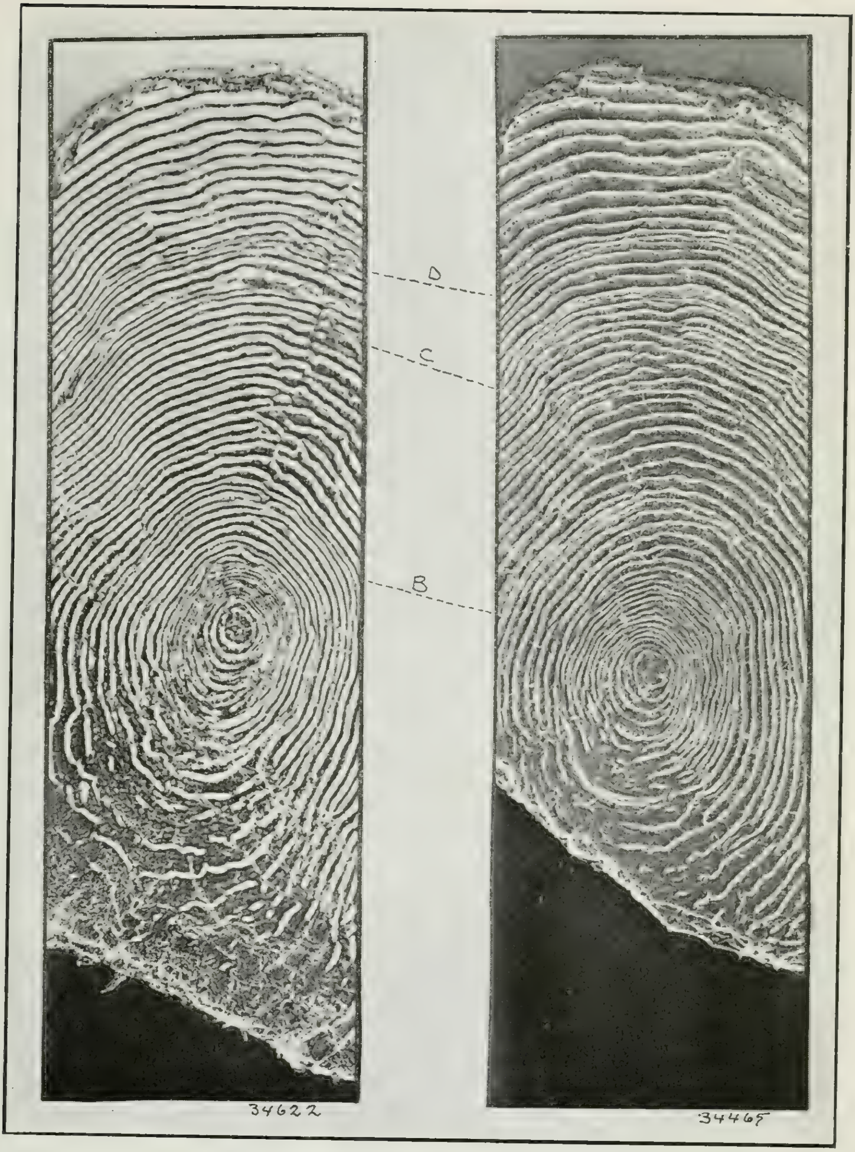

PLATE V.

FIG. 49. Scales of marked (34622) and unmarked (34465) king salmon grilse which returned to Klamathon racks in 1921.

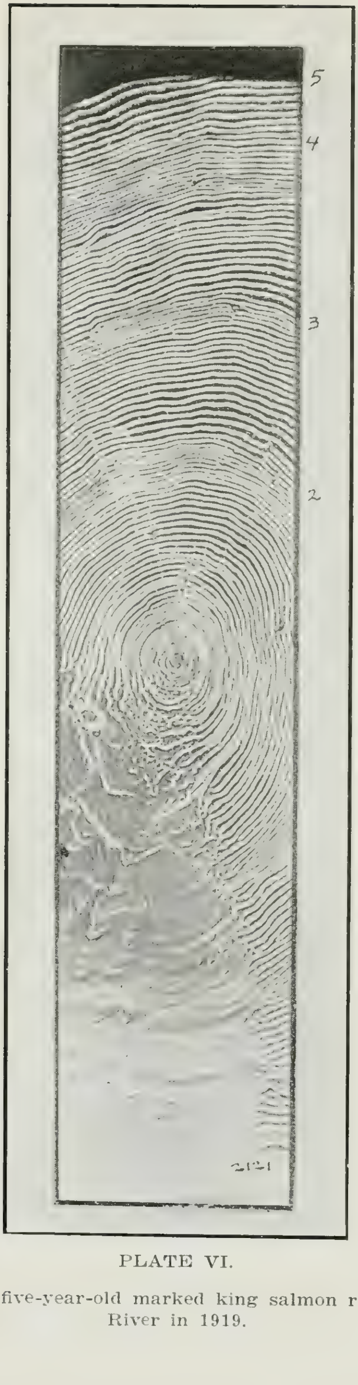

PLATE VI.

FIG. 50. Scale of a five-year-old marked king salmon recovered in Klamath River in 1919.

is shown as figure 48. A comparison of this with figure 43 is made easy in figure 49, where selected parts of each are placed side by side. There is here demonstrated the possibility of recognizing unmarked fish which are liberated with marked ones, providing all were treated alike, and this will warrant the close scrutiny of a great many four-year fish which enter the Klamath a year hence, especially at the Klamathon racks, where all that escape the vicissitudes of sea and river may be expected to arrive.

In 1919 a single marked fish was obtained in the Klamath estuary as the only result of an experiment initiated in 1916. An account of this experiment reads as follows (California Fish and Game, Vol. 2, No. 4, p. 209): "On February 15, 1916, 3500 marked yearling quinnat salmon were liberated in the Klamath River at Klamathon. They were hatched at the Sisson Hatchery from eggs taken on Butte (meaning Battle) Creek in November, 1914. Each was marked by removing the left ventral and the adipose fin. It is expected that a few of these will be recovered in the Klamath River in 1917 as male grilse, and that both males and females will be taken in 1918, 1919 and 1920 as 4, 5 and 6-year-old fish." The single fish recovered was first observed by Henry Jackson, an employee in the cannery of the Klamath River Packers Association at Requa, August 29, 1919. The specimen was presented to an agent of the Fish and Game Commission by Mr. G. R. Field. It measured 43 inches and weighed 35 pounds. Its age is plainly shown by the character of one of its scales in figure 50. Because of unfortunate circumstances, no very definite effort was made to recover marked fish from this experiment until it was almost too late, and the very meagre results serve to illustrate the futility of initiating an experiment when not fully prepared to closely follow it up.

The experimental planting of 1919 now gives promise of unusually good results, and no reasonable effort should be spared to secure full data relating to it. Fish bearing its mark may appear along the coast in the catches of trollers, and thus offer some evidence relating to the contribution of Klamath salmon to sea fisheries. It is known that Klamath fish are caught at sea, as salmon on entering the river bring from time to time mute evidence in the form of embedded hooks, and even entire spoons, which look like those used in sea trolling to the southward.

This particular experiment is part of an effort of the Fish and Game Commission to accumulate facts relating to the habits and distribution of the king salmon which shall contribute toward the conservation and maintenance of the fishery. It is of interest to fisherman, dealer, packer and consumer alike, and no opportunity should be lost to contribute to its results. Any one so fortunate as to catch one of these fish should make an accurate note of it. He should measure its length from the snout to the end of the middle part of the tail (see figure 40), determine its sex, cut the mutilated fins from the body, including a liberal piece of skin, scrape a hundred or so scales from near the middle of its side, write down the date and exact locality of capture, the name and address, and mail the entire data to the Fish and Game Commission. The fins should be well salted, and the scales may be spread out between two papers.

THE WHY AND HOW OF MOUNTAIN LION HUNTING IN CALIFORNIA.

By **Jay Bruce**, State Mountain Lion Hunter.

The importance of the control of the mountain lion (*Felis concolor*) as an aid in game-conservation can be appreciated when it is realized that the present lion population of California is scientifically estimated to be about 600 lions, and their annual kill of deer 30,000 head. This is over twice the number known to be killed by human hunters. Since does are probably about five times as numerous as bucks, a lion has five chances to kill a doe for one chance to kill a buck. So, naturally, most of the deer killed by lions are the breeding stock of females.

Although deer form their principal food, lions also kill thousands of dollars worth of domestic stock every year, even including full grown cattle. In fact, no animal in California is entirely exempt from the bloodthirsty instincts of these animals. I know definitely of lions having killed and eaten foxes, skunks, coons, porcupines and bobcats. I also have reliable information of several instances where lions have killed and eaten domestic dogs, while two lions now in captivity in the Yosemite Valley killed and ate a cub bear which managed to get into the lions' cage from his own adjoining cage.

The lion problem has been intensified by the establishment of a chain of game refuges where no public hunting is allowed. The breeding stock of deer and other game is fast increasing in these areas, and naturally the lions accumulate there. Since the lion's instinct is to kill at every opportunity, the most damage will be done where deer are most numerous.

In order to meet this condition a high state bounty was advocated. It seemed doubtful, however, whether a $100 bounty would attract enough hunters to confer a benefit anywhere in proportion to the additional cost, as will be shown later. Another method of control considered was the employment of experienced lion hunters on a regular salary, plus the present bounty. As an experiment along this line the writer was employed by the California Fish and Game Commission, on January 1, 1919. This system costs only about $2000 per year, as against the $15,000 by the increased bounty, and lions are killed where there is the most need of killing them. The main object of the plan adopted was to control the lions in game refuges, and then to answer any calls where lions were doing unusual damage. During the last three years I have accounted for ninety lions, as follows: 1919, twenty-six lions; 1920, thirty lions; 1921, thirty-four lions. Most of these were taken in and around game refuges. Since October, 1908, the California Fish and Game Commission has been paying a bounty of $20 for each mountain lion killed. Claims for such bounty are made on blanks furnished by the commission, and every claimant has been requested to furnish the commission with a written statement showing where the lion was killed, why it was killed, the damage done by the

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Note.—There have been few articles appearing in California Fish and Game of more general interest than the one offered here, written by a man who probably knows more about the habits of the mountain lion than any other Westerner. In bagging 121 lions, Mr. Bruce has traveled on foot over 10,000 miles, hunting, trailing, and studying their habits.—Editor.

lion, methods used in taking him, and the sex of the animal. In July, 1917, the bounty on female lions was raised to $30 per head.

The information sent in by claimants for bounty indicates that nearly all of these lions were killed either accidentally or because they were doing damage to stock, and not on account of the bounty. Now if the bounty were raised to $100 per lion, the state would be paying $75 more on an average for each lion now killed under the present bounty, and this would amount to about $15,000 annually.

From the foregoing it might be argued that the present bounty is useless and should be abolished, so let us examine and see what benefit is derived from this expenditure. It is evident that no situation can be handled intelligently or with efficiency without accurate data as a basis for action. Now on account of the bounty of $20 paid since 1908, the commission has been furnished with the following data:

FIG. 51. One hundred and fifty pound male lion treed near Lynchburg ranger's station, Placer County, November 1, 1921.

The number of lions killed during the last thirteen years;

The proportionate number of these killed from year to year under a given condition, which should indicate the comparative lion population;

The damage known to have been done by each lion;

The methods used in taking the animal;

The percentage of each sex killed since 1917.

These data are of immense value in any effort to control the lion, and are now being used to advantage for that purpose by the commission. For instance, we find from an examination of these data that the range of the lion on the western slope of the Sierra Nevada Mountains between Siskiyou County and Kern County, is confined to a straight belt about fifteen miles wide by section lines, and at an elevation between 3000 and 5000 feet above sea level and averaging 4000 feet. The same elevation will apply to the range of the lion in the Coast

Range Mountains. All the country above or below this belt can be eliminated as lion country for all practical hunting purposes.

The lion does not habitually follow some of the deer to the higher mountains in summer and other deer to the foothills in winter, as many people suppose. This lion belt is so well defined in the Sierra that we can draw a straight line through the center of the belt, from a point in Siskiyou County to a point in Kern County, and it would be possible for a hunter to camp along this line and kill approximately every lion on the western slope of the Sierra. Of course a lion will occasionally stray out of this belt temporarily, but he soon returns, for his natural home is there. The lion probably selects this belt because it is the natural home of the deer. The variety of *ceanothus,* commonly called deer brush, which is the principal food for deer, grows in abundance in this belt between 3000 and 5000 feet elevation. The deer that summer higher winter here, and those that winter below summer here. Most of the deer stay here all the year, so this area is the best all-year range for them. In other words, the maximum deer population is to be found in this area. For this reason the lioness selects some place in this belt when her young are to be born. She usually has two or three kittens, although sometimes only one, and occasionally four, are born in a litter. On account of many females not mating every year, the yearly increase probably averages one kitten for each adult female. The lair is usually located around some bluff or pile of rocks, which furnishes places for shelter and concealment of the kittens when small.

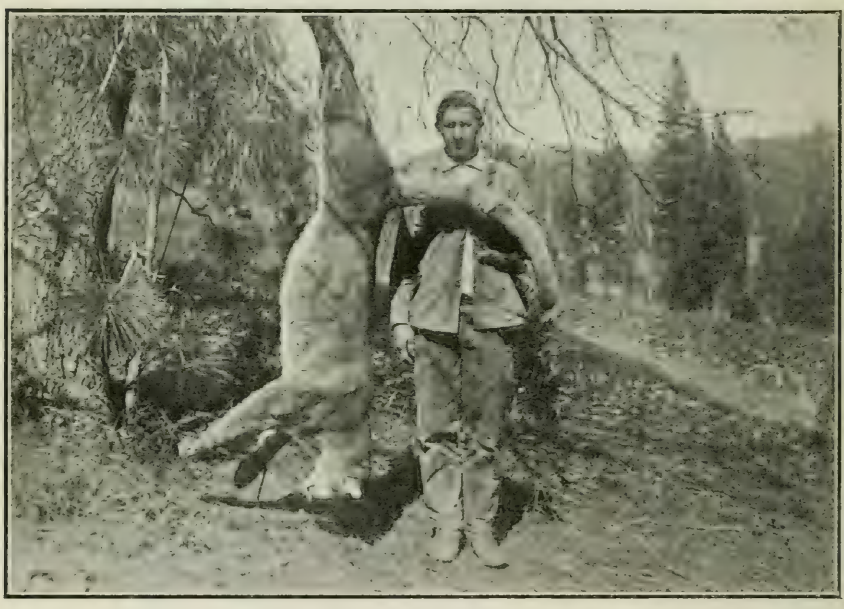

FIG. 52. A large 160-pound male lion which measured 7 feet 3½ inches. Killed near Avery, Calaveras County, in March, 1921. Photograph by L. V. Peterson.

In my experience, the kittens are born in either February, April, August or November. The mother nurses them for about two months, and probably brings them some food in her stomach during that time.

After they are weaned she makes a kill and moves the kittens to it, leaving them to eat it while she goes away hunting. She continues moving the kittens from kill to kill until they are about six months old and weigh about 35 pounds for females and 50 pounds for males, by actual scale weight. They now hunt part of the time with their mother until they are about a year old and weigh about 65 pounds for females and 80 pounds for males. The mother then abandons them. The kittens sometimes continue to hunt together for a few months longer, when they finally separate, selecting different beats, but still in the same belt where conditions are the same as where they were raised.

When fully matured the male weighs from 140 to 160 pounds and measures from 6½ feet to 7½ feet from tip of nose to tip of tail. The female weighs from 90 to 105 pounds and measures from 6 feet to 7 feet from tip to tip. These are actual scale weights and tape measurements.

The adult male accompanies the female only during the mating period and does not help to feed and care for the young. Lions do not make their kills by lying in wait on the limbs of trees and springing from there. In fact, I have never known of a lion climbing a tree except to avoid the dogs. They tirelessly hunt and stalk their quarry on the ground, taking advantage of every cover, and finally rushing from a distance of 40 or 50 feet. This distance is covered in about a second. A 100-pound lion moving at a velocity of 40 feet per second will strike a blow sufficient to prostrate a yearling steer. The heavy muscles of the lion's neck, shoulder and forepaws are tense for the blow, and easily absorb the shock that prostrates his unsuspecting victim, which is then killed by being disemboweled. The liver is eaten first, and then the loins and hams. An examination of probably 100 deer killed by lions showed no evidence of the lion having touched the throat of any of these kills.

I have found the lion to be normally a solitary and invariably a silent animal. I have never heard that hair-raising scream the lion is supposed to utter, and I do not believe it makes any loud sounds, but that the noises usually attributed to it are made by owls and coyotes. On one occasion of which I know, about fifty guests at a mountain resort were listening one evening to the braying of a mule colt, and were told in good faith that they were hearing a mountain lion scream. Every one of these people, including their informant, probably believes to this day that they were hearing a lion.

Some writers have condemned the mountain lion as being cowardly and unwilling to attack in the open, but they lose sight of the fact that the cat family is short-winded and unable to capture its prey by running it down as the dog family does. If the lion should openly approach his prey and challenge it to combat, his intended victim would immediately take to flight, leaving the lion to go hungry. His only means of making a living is to surprise his quarry. In a fight to the death, the mountain lion is more game than the black bear. He will fight with his last breath, when the black bear will quit and cover his head with his paws and bawl like a calf.

The most reliable method of taking lions is trailing with dogs, and the best dogs for this purpose are fox hounds. A hunter requires at least four dogs, which must be highly trained on lions and thoroughly proof on deer and other game, as there are probably a thousand head of deer and other game combined, for each lion. The dogs are used in pairs, allowing each pair to rest every second day, as a dog uses so much energy in running, baying and wagging his tail during ten or twelve hours of trailing that he needs one day's rest for each day of work. Furthermore, a dog's feet will not stand continuous hunting.

To be successful, lion hunting must be done intensively. Since a lion does most of his prowling at night, the hunter must leave camp early and travel fast, in order to find a fresh trail and have the most hours of daylight to trail the lion down, as a person can neither travel to advantage in the mountains after dark, nor see tracks when necessary to help the dogs. A lion travels a regular beat over about 100 square miles, usually making his round about every four or five days, so as soon as some part of this beat is learned, the hunter has a clue to work by. Since the dogs can smell only a reasonably fresh track, the hunter can not depend entirely upon their sense of smell to find the trail, but must always watch the ground carefully for any old signs which would indicate the places where a lion had been traveling.

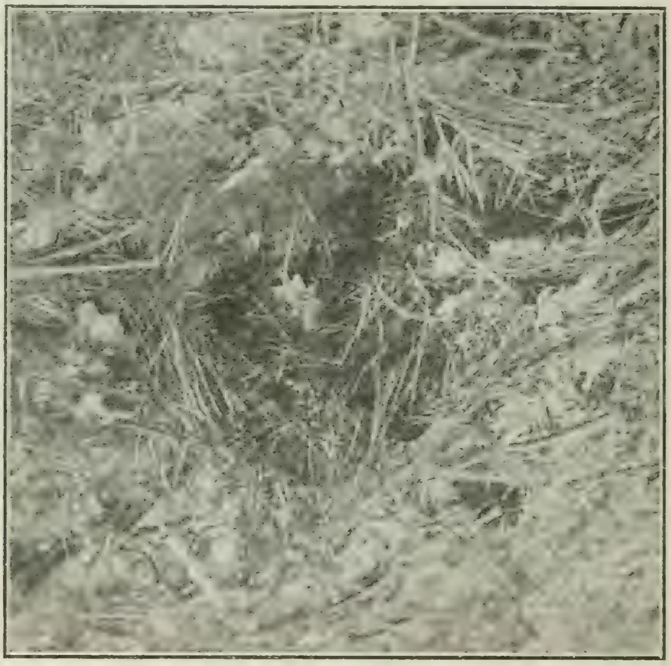

FIG. 53. Mountain lion scratches.

The signs left by lions are fresh or old kills, dung and tracks, and if a male is traveling a beat the plainest sign will be marks about a quarter to a half mile apart along the beat and apparently made by the lion digging with his forepaws in the dead leaves near the base of a tree or in the rotten wood near an old log (see figure 53). These marks are all alike and can not be mistaken for anything else when once learned; they are made only by the male and are a sure indication to the hunter of the sex of the animal he is trailing. After some part of the lion's beat has been learned, that part must be hunted first every day, continuing the hunt then from there. If one day is missed and the lion passes, the track may be too old for the dogs when it is found the next day, and this may mean four or five days before the trail is again found fresh enough for the dogs to follow. A dog can not follow any but a very fresh trail on hot and dry ground or in dust, so the hunter must use his eyes to help the dogs past such places. In the cool, damp weather of winter a twenty-four hour trail can usually be successfully followed, while in the hot, dry weather of summer a six-hour trail is found difficult. When snow is on the ground, trailing is easy and a four or five-day-old track should be followed, as a lion may make a kill at any point on his beat and may have returned for a feed, allowing the hunter to get a fresh track at the kill. I estimate that while killing 120 lions I advanced an average of about fifteen miles the day the lion was killed. This distance does not take into account many loops made in looking for tracks when it was necessary to help the dogs. Many times I have trailed a lion this distance each day for three or four days before bagging him. Several times I have advanced twenty-five miles, and once thirty miles, the day I got the lion. Generally the hunter travels on foot over 100 miles for each lion killed. I estimate that on the average trail my dogs will travel about five times the distance advanced. To me it is very interesting to watch a hound on the trail. He rushes along with nose close to the ground, head sweeping from side to side and tail wagging furiously, stopping suddenly as he catches the scent, smelling intensely for a moment to make sure, then throwing up his head and baying loudly as he rushes ahead for a hundred feet or so, then trying again for the scent, and circling until the trail is located. Now another rush ahead, and so on for twelve or fourteen hours, or until the constant baying indicates that

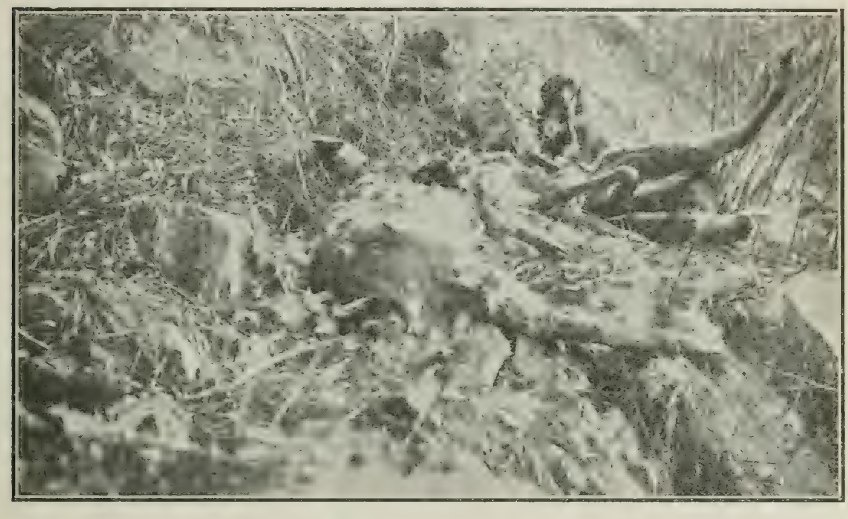

FIG. 54. Doe and fawn killed by mountain lion near Bear River on north fork of Mokelumne River.

the lion has been routed out of his bed and is making away, with the dogs in close pursuit. The hunter knows when the lion is finally treed, by the changed note in the baying of the dogs and by the fact that the baying comes continually from one place. On arriving at the tree, he can see anywhere from 100 to 160 pounds of cat, standing among the branches, usually about 30 feet above the ground. The lion may be just watching the dogs with interest, or he may be very angry, which is indicated by his constant growling.

At the crack of the gun, out he goes, and even though shot through the heart he may still be able to seriously injure a dog. For this reason it is best to tie the dogs before shooting.

It is quite an exciting experience to see a wounded adult lion on the ground, trying to hold at bay from two to four frantic dogs. Every moment will be full of action, as the dogs attack from different directions and the lion continually turns to meet each attack. All the while he is growling and spitting savagely, his ears flat back, mouth wide open, claws unsheathed and hair and tail standing up. If the dogs crowd him too closely he turns over on his back and fights with his mouth and all four feet at the same time. Now is the time for the hunter to rush into the fray, shove his gun between the frantic dogs and get in a fatal shot.

BLACK BASS SHIPMENT TO MEXICO.

By George Neale, Executive Officer, California Fish and Game Commission.

In 1909, at the request of the Mexican government, Mr. Chas. A. Vogelsang, at that time chief deputy of the California Fish and Game Commission, made arrangements for the shipment of black bass to Lake Chapala, Mexico.

The California Fish and Game Commission's distribution car No. 1, in charge of the writer, left Fresno early in December, 1909, with ninety-two cans containing about 1800 adult black bass. Some weighed as much as three pounds. After many delays, Ocotlan, on the shore of Lake Chapala in the Mexican state of Jalisco, was reached. Here the first planting was made. Seventy-two cans were transferred to lighters, which were towed by launches to the south end of the lake, where the fish were liberated. Some of them immediately began feeding on the minnows.

We were then taken to the governor's palace on the shore of Lake Chapala, and were lavishly entertained by Governor Landa. Accompanied by the governor's quartette of guitarists, we returned to Ocotlan after midnight in a terrific blow.

Lake Chapala is a magnificent body of water, larger but not so beautiful as our own Lake Tahoe. It contains a food fish known as the whitefish, which differs from our whitefish in that it is transparent. But it furnishes a fine food for the black bass, which food is most necessary to insure increase. Lake Chapala is also said to contain carp, but we did not see any. This lake should now (eleven years after the planting of these black bass) be an anglers' paradise for those who know how to lure the fish, which are, as Dr. Henshall states, "inch for inch, pound for pound, the gamiest fish that swims."

Our next stop was at a small lake a few miles north of Mexico City, in which we planted twenty cans of black bass. We accomplished all this with the loss of but two fish.

We were met at Mexico City and taken to dinner at the magnificent restaurant "Chapultepec," at the foot of the castle of the same name, which once was the home of Montezuma. We quartered at the St. Francis Hotel, then a magnificent hostelry of the old Mexican type, and were royally entertained by the government. While there an amusing incident occurred, which illustrates the manner in which we were entertained. After signing the meal check, showing what we had received and the cost of the same, which was paid by the Mexican government, our interpreter came to us and said, "We observe there is no wine or liquor charged. Is it because you do not drink wines or liquors, or do we not have the kind you are used to drinking? If not, we will get the brands you care most for." We thanked him and

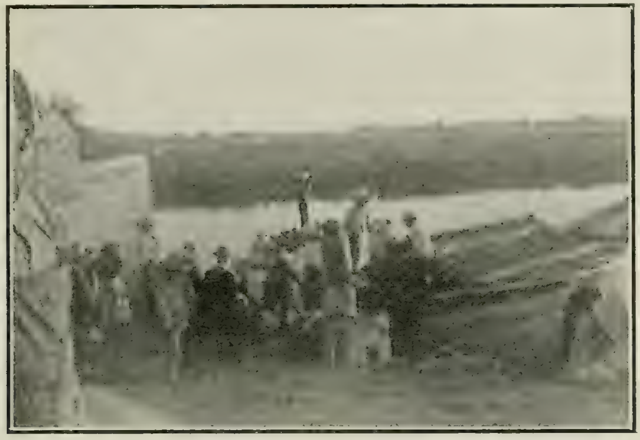

FIG. 55. Planting black bass in Lake Chapala, Mexico.

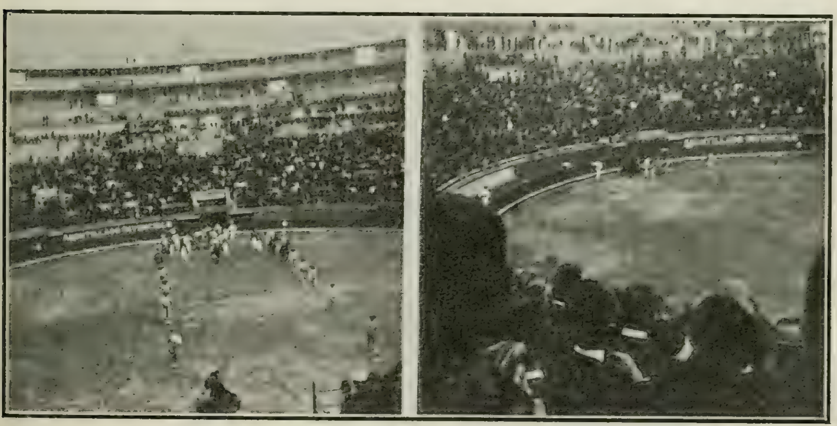

FIG. 56. Scenes at a bull fight at which employees of Fish and Game Commission were guests after conveying California black bass to Mexico City for planting.

assured him that nothing but our modesty had prevented us from ordering the most select wines.

Automobiles were placed at our disposal. The Christmas festivities were in full blast, and we had special seats for the opera, "The Merry Widow," also seats at the bull fight, which was attended by President Diaz and 48,000 people. We shall always wish to forget the bull fight. We were unable to leave the arena, so were compelled to witness some of the most shocking brutality and cruelty ever perpetrated. Thirteen magnificent bulls were slowly tortured to death. Eleven horses were gored and dragged out of the arena alive, their entrails protruding, amid the plaudits of 48,000 representative citizens. It is puzzling to know that people possessing such qualities of refinement and hospitality can witness such brutality.

Believing that it would be of interest to obtain information as to the success of the planting in Lake Chapala, the Mexican consul in San Francisco was appealed to, with the result that the following interesting reports were received:

(TRANSLATION.)

Government of the Free and Sovereign State of Jalisco.
Section Fourth, No. 16582.

To the Consul General of Mexico,
519 California Street, San Francisco, California.

Referring to your attentive communication dated October 31st last, by which you request information as to the success attained in acclimatizing in the Lake of Chapala the fish called black bass (lobina), I beg to inform you that I have, on my part, requested this information from the city mayors of the lake cities and their replies were the following:

Chapala Mayor's report:

"I have the honor to refer to your respectable communication issued by Section 4th dated on the 12th inst. and in reply to it I beg to inform you that in the Chapala Lake can be found the fish called BLACK BASS, in short number being more abundant toward la Cienega, La Palma and Jamau as I have been informed; in this place are caught very few of them due to the fact the fish named Carp (CARPA) fight them to death destroying either the fish itself or their spawn, being more destructive in the latter case which danger has not been possible to avoid on account of the latter named fish Carp is a courageous fighter against the other less warlike fishes as is the case with the WHITE FISH, BLACK BASS and other named CHARAL. This is, in my opinion, the cause that the fish in question is not more abundant, although I believe in its acclimatizing."

Jocotepec Mayor's reported on the 20th inst:

"Informed to my satisfaction from the most prominent fishers of the Lake of Chapala, in this region, I have the honor to say in response to your communication No. 9508, issued by Section 4th on the 12th instant that: on the shores of said Lake within the limits of this Municipality, they have not fished the BLACK BASS (Lobina) or Delicious fish that is known but it is believed it can be found in Jamay or in the emptying of the Rio Grande into the Lake."

Jamay Mayor's reported on the 29th inst. as follows:

"In reply to your communication No. 9509, issued by Section 4th on the 12th inst. I state that after the investigations made in order to find if the fish known by the name of LOBINA the fishermen of this place only informed me on the fishes they fish in this part of the Lake, viz: BAGRE in very short amount, the WHITE FISH very scarcely and that the fish named Carp is the more abundant."

Tuxcueca Mayor on the 20th inst reported:

"I beg to inform that respectable Government that in the region of Lake Chapala within the jurisdiction of this Municipality the fish known by the name of LOBINA has not been found and that I ignore whether this fish is to be found in any of the other Municipalities around the lake."

Tizapan Mayor, under the same date as the above, report as follows:

"I have the honor to inform you in accordance with the inquire contained in the communication of that Superiority under the number 15006, issued by Section 4th dated on the 15th inst. that on information collected from the fishermen within the jurisdiction of this Municipality is not known the fish named LOBINA mentioned in your said communication in any of the places where the fisheries are established."

Ocotlan Mayor under same date report:

"Relative to your attentive note No. 9510, issued by Section 4th dated the 12th of November ultimo in which you transcribe me the communication dated on the 21st of October last from the Consul General of Mexico in San Francisco, California, for the knowledge of the Governor of the State I have the honor to inform you that the fish known by the name BLACK BASS (Lobina), delicious fish, to which the preinserted note makes reference and known in all these places with the name of (LIZA) has been propagated relatively little in the Lake of Chapala and in a nearby place to El Fuerte, within the jurisdiction of this Municipality and in which place about 15 fifteen years ago approximately this fish was placed for its propagation but we have information that in the town of Poncitlan it is found frequently in the dam and in the river passing by that place."

Please to accept my attentive and distinguished consideration.

THE CONSTITUTIONAL GOVERNOR OF THE STATE.

Guadalajara, Jalisco, December 23, 1921.

The stated fact that black bass have not multiplied to any extent in the lake for the principal reason that carp have destroyed the spawn, is hardly plausible, for unless the Mexican species of carp is as aggressive and courageous as the Mexican bull, this is not the reason for the apparent lack of increase. Both the male and female black bass remain with the eggs in the nest until they are hatched, and both remain with the young fry afterwards. There is no American fish bold enough to attack a black bass or its eggs. In lakes where bass only abound, necessity compels the adult fish to devour its young, but Chapala has an ideal food in the whitefish. We have made many plantings of bass and have never seen a body of water having more of the requirements necessary to the successful introduction of these fish than Lake Chapala.

The black bass are the most difficult fish to catch with a net. They require certain lures to take them, such as live minnows, spinners, etc. In a body of water the size of Lake Chapala, containing all the natural feed, these fish are doubtless difficult to capture. In spite of the foregoing report, we feel positive they are present in large numbers and can be taken by those who know how.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to **H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.**

APRIL 22, 1922.

"Of all sports, commend me to angling; it is the wisest, virtuousest, best."—*Thomas Hood.*

NEW EXECUTIVE OFFICER.

On March 14 Mr. Charles A. Vogelsang, who has been executive officer since 1920, resigned to accept another, more remunerative, position. Mr. George Neale, who has been in charge of the Sacramento district office since 1911, was appointed to succeed Mr. Vogelsang. Mr. Neale comes to his position as one intimately acquainted with the fish and game of this state and the problems connected with its conservation. Every employee of the commission is extremely well pleased with the appointment, for they know that from the standpoint of knowledge, experience and personality, Mr. Neale is well equipped for his future work. It is fortunate, also, that the new position comes as a promotional appointment under civil service.

George Neale, executive officer.

George Neale came to California when he was sixteen years of age, spending two years in San Francisco and then settling in Sacramento, where he entered the market produce business. Due to his interest in fish and game he was appointed game warden of Sacramento County in January, 1901, and two months later was appointed a deputy state fish and game commissioner. He proved himself a capable warden, cleaning up a particularly bad situation due to the laxity of enforcing the laws. On August 3, 1911, he was placed in charge of the Sacramento district office, which he has efficiently managed up to the present time.

Mr. Neale is an ardent angler and hunter and a true conservationist, and sportsmen and conservationists alike may look forward to an efficient administration of the fish and game resources of the state.

A HATCHERY NUMBER.

Perhaps the most outstanding achievements of the California Fish and Game Commission have been the successful introduction of numerous food and game fishes and the artificial propagation of trout and salmon for use in stocking barren streams and lakes and restocking depleted waters. Everybody knows from the local papers that sometime during the summer and fall the fish car makes an annual visit to some town close by and that thousands of trout fry are carried to nearby streams by interested sportsmen, but of methods and actual output from the hatcheries the average citizen knows little. How many hatcheries are there? What is the annual output? How are trout fry planted? These and many more questions are answered in this "Hatchery Number."

The Fish and Game Commission boasts of having retained the continuous services of a skilled fishculturist for thirty-nine years. Mr. Wm. H. Shebley, in charge of fishculture, whose picture is shown above, has the distinction of being the commission's oldest employee and of having been trained under such pioneer fishculturists as Livingston Stone and J. G. Woodbury; Mr. Shebley, in consequence, knows California conditions and knows how to raise fish. The hatchery department has many employees who have "grown up" with the work. One of the employees, Mr. E. W. Hunt, field superintendent, has served the commission for thirty-five years; two others have served more than twenty-five years; four, more than fifteen years, and six for more than ten years. The efficiency of the department can be partly traced to the fact that the men engaged in fishcultural work are all experienced men.

William H. Shebley, in charge fishculture.

INCREASING DEMAND FOR TROUT FRY EXHAUSTS HATCHERY RESOURCES.

Easy access to the streams and lakes afforded by the improved highways and the increasing use of automobiles, and the added thousands of people who are availing themselves of the opportunity to fish, are factors that have combined to make an ever-increasing demand on our hatcheries for fish for restocking. Each season sees a marked increase in the number of people who seek recreation in our mountainous districts, and the consequent drain on the trout in our lakes and streams has been very great, particularly during the past five years. To meet the need, the department of fishculture has exhausted its resources. Every available dollar has been devoted to fishcultural work, and yet the demand increases.

Only a partial solution is possible as a result of the reduction of the bag limit from fifty to twenty-five. It may be that a shorter fishing season will have to follow in order that depleted streams and lakes may be afforded a chance to recover their former condition.

Every state in the Union where there is game fish to be found is confronted by the same problem. In most cases the condition is being met by an increased angling license to provide more funds for enlarging the output of the hatcheries. This is the remaining remedial measure left to California.

FREE FISHING FOR ALL.

For fifty years the Fish and Game Commission has been stocking the lakes and streams of the state with trout. That any of these stocked lakes and streams should become private property, with consequent restriction of fishing, would be an injustice. Several years ago the actions of certain riparian owners caused the commission to advocate the passage of a law providing that boards of supervisors could, if necessary, condemn a right of way along a stream for the use of fishermen. This law was passed. In recent years there have been many attempts by private individuals to close public fishing on certain lakes and sell fishing privileges for as much as $10 a day. The one thing that has saved these lakes from becoming private preserves has been the fact that the state has annually stocked them, and consequently the fish do not belong to the riparian owners. Likewise, the importation of trout fry from other states has been discouraged, in order to prevent like developments. It seems reasonable that those who would make private gain from fish should utilize artificially constructed ponds, rather than publicly stocked waters. The commission positively refuses to stock with trout fry any waters of the state which are not previously declared in writing by the owners to be open to the general public for fishing purposes.

The Fish and Game Commission believes in championing the people's rights. This is substantiated by the attitude on proposals for making private fish preserves out of streams and lakes stocked by the state and by the action taken during the last legislature, when the attempt was made to place fish and game administration under a subsidiary division of the Department of Agriculture.

CONDITIONS SHOULD DETERMINE SPECIES OF TROUT PLANTED.

Many of the applicants for trout fry specify a preference for rainbow. There is no doubt but that the rainbow is the gamiest of the trout, and usually superior for food, also; but it must be remembered that some of the introduced species do better than our native trout in some localities. The eastern brook trout, although a failure in coast streams, thrives in the slow-moving, meandering stream of a mountain meadow, whereas the rainbow is at his best in the rushing, boulder-strewn stream of the granite-walled canyons. Furthermore, it has been found that the brown trout thrives in certain streams where attempts to furnish good fishing by planting rainbow failed. The Loch Leven makes a splendid stream and lake fish and grows to large size. The steelhead, which furnishes a better supply of eggs than the rainbow, makes a suitable substitute for the rainbow in most situations. Were a sufficient and economical supply of rainbow eggs available, the commission would be pleased to supply the constant demand for this species, but the securing of a larger supply than is now obtained is difficult and expensive as well. The fishcultural department is in a position to know what species will thrive best in the different localities, and it attempts to allocate the fry accordingly.

THE PLANTING OF FRY.

The Fish and Game Commission is constantly receiving requests from all parts of the state for assistance and cooperation in planting trout and other fry in the waters of the state. It has been and is becoming more and more impossible for the commission to bear the additional expense of planting fry, as increasing demands necessitate the use of all funds available for the propagation and rearing of the fry to the planting stage. The expense of distribution has for many years been cheerfully borne by anglers' associations and individuals most interested. That this method of planting continue seems the more reasonable, because of the increased cost of transportation and because of the personal interest developed. During the war all free transportation of fish and employees engaged in fish planting was cancelled by the railroads, and the former privileges have never been restored. The commission now pays full transportation for the two fish cars and employees, and the annual bill amounts to thousands of dollars. From the standpoint of conservation the present method is desirable, for the reason that individuals or associations cooperate with the commission in planting fish and assume an interest in the plant made, and good publicity results from the cooperation. Apparently, neither anglers' associations nor individuals have found their share of the work a burden.

ELECTRIC FISH SCREEN.

Several articles have appeared in recent periodicals relative to the perfection of an effective screen utilizing an electric current for use in irrigation ditches. These articles are altogether too optimistic, in the light of investigations made by the California Fish and Game Commission. On several different occasions the apparatus has been given a thorough test and found unsatisfactory. Young fish, placed in a ditch for experimental purposes, readily ran between the electrodes when the current was not too strong, and were quickly killed by the current as soon as a certain voltage was obtained. Considerable time and money have been expended by the commission in an endeavor to test and see whether electricity could be used advantageously as a means of screening fish from irrigation ditches. But up to the present time no one has satisfactorily demonstrated that this principle is practical when trout and salmon are to be prevented from passing into large ditches or canals. Further experiments will be made this coming season on an improved method of using the electrodes.

MANY SPECIES OF TROUT SUCCESSFULLY REARED.

The species of trout which have been successfully reared at state hatcheries follow:

NATIVE.

McCloud River rainbow	*Salmo shasta*
Rainbow	*Salmo irideus*
Cut-throat	*Salmo clarkii*
Steelhead	*Salmo gairdneri*
Black-spotted	*Salmo henshawi*
Large lake	*Salmo tahoensis*
Golden	*Salmo roosvelti*

INTRODUCED.

Eastern brook	*Salvelinus fontinalis*
German brown	*Salmo fario*
Loch Leven	*Salmo trutta levenensis*
Mackinaw	*Cristovomer namaycush*
Landlocked salmon	*Salmo salar sebago*
Grayling	*Thymallus montanus*

Experimental hatching of several other food fishes has been undertaken at various times. Included were the whitefish, striped bass, shad, muskallunge and Japanese ayu.

FISH TRANSPORTATION.

At first, transportation of fish to the stream was accomplished with horse and wagon, or by direct express shipments or in baggage cars. At the 1909 session of the legislature $7500 was appropriated for a fish car and equipment. The car, 60 feet long, was built in the shops of the Southern Pacific Company at Sacramento and is still in use. It is fitted up with an engine-room in which is located a boiler for generating steam to run two Westinghouse air-pumps, used for forcing a circulation of air through a series of pipes and tubes into the 125 cans that the car is equipped to carry; also a refrigerator, tanks for carrying a supply of fresh water, berths for the attendants, a culinary department, an office for the superintendent of the car, besides lockers for the tools and equipment required in carrying the fish. This car has enabled the commission to carry thousands of fish in perfect condition all over the state, at a saving in the cost of transportation amounting to hundreds of dollars each season. Formerly it required two men to care for 12 or 15 cans; in the special car four men can care for a load of from 100 to 125 cans, carrying from 200,000 to 400,000 fish. Since the car has been in operation, three times as many fish as before have been distributed during the same period of time. Furthermore, the fish carry better and are delivered in better condition. A second fish car was put in operation in 1915.

In recent years the motor truck has played an important part in transportation. The Mount Whitney Hatchery is equipped with two large trucks. There is a one-and-a-half ton truck in use at the Mount Shasta Hatchery; the distribution of fish from the Feather River Hatchery is handled with a two-ton truck and each of the other important hatcheries has a Ford truck as part of the equipment.

From the nearest railway station the fish are carried to the mountain stream either by truck or by pack train. Special pack-cans are utilized with animals, and the fish stand long journeys without injury.

TROUT FOOD INTRODUCED.

It seems reasonable to believe that an increased food supply for trout in certain streams might increase the supply and better the fishing. The commission has consequently experimented in the transplantation of certain insects and crustaceans notable as food for trout. As early as 1897 crawfish and salmon flies were introduced into the Truckee basin. In more recent years salmon flies have been introduced and now thrive along many streams in the Tahoe region.

IN MEMORIAM.

George McCloud departed this life October 19, 1921. He was born near Gazelle, Siskiyou County, June 24, 1863. The son of Ross A. McCloud, one of the pioneers of Siskiyou County, who at one time was county surveyor, George McCloud spent his childhood at Upper Soda Springs and at Yreka.

He was educated in the common schools of the county and in Ashland Academy. After leaving school he was employed on the survey of the Southern Pacific Railroad under Chief Engineer William Hood, when that road was being surveyed and built through the Sacramento Canyon and over the Siskiyou Mountains.

In 1886 he came into possession of a half interest in the Upper Soda Springs resort, and with his sister, Mrs. Elda Massen, operated this popular resort for a number of years. During this period he established a resort on McCloud River, that was named after his father. The best information that the writer can obtain regarding the origin of the name of McCloud River, is that it was named after Mr. McCloud's father, Ross A. McCloud. This statement has been disputed by some, who claim that the river was named after a man named McLeod, who was in the employ of the Hudsons Bay Company as a trapper, but there is not any doubt in the minds of the first settlers that the McCloud River was named after Ross A. McCloud, who came to Siskiyou County in the early fifties and prospected on the river that was given his name by early settlers. George McCloud sold his McCloud River property in 1890 to Clarence Waterhouse, who employed him as his fiduciary agent in charge of his property on the McCloud River, as well as on a mining venture in Alaska.

George McCloud was a thorough sportsman and enjoyed the esteem of the best sportsmen in California. His knowledge of wild life, particularly the fishes of Northern California, gave him an enviable reputation, and his services were often sought by those who desired to enjoy an outing where good fishing could be had.

In 1911 he entered the employ of the California Fish and Game Commission.

His knowledge of the trout and salmon was of great value to him in his new position, and he made rapid progress in his work. He was employed as fishculturist in charge of an egg-collecting station, and superintendent of one of the commission's distribution cars, until his illness early in the summer of 1921 caused him to retire.

Mr. McCloud's death is deplored by a host of friends. He was an honest, upright and concientious man. In his passing the Fish and Game Commission lost an efficient and dependable employee.

George McCloud, pioneer of Siskiyou County, for many years a trusted employee of the Fish and Game Commission.

There survive to mourn his loss his wife, Mrs. Mary McCloud; two sons, Ross A. McCloud, who succeeded his father as superintendent of distribution car No. 2, and George McCloud Jr., superintendent of Mount Whitney Hatchery; two daughters, Mrs. Carrie Hickman and Mrs. Ruth Wheeler, and a sister, Mrs. Elda Massen.

RAINBOW TROUT THRIVE IN HAWAIIAN ISLANDS.

Within the past few years the United States Bureau of Fisheries has sent two lots of rainbow trout eggs to the Hawaiian Islands: 50,000 in the spring of 1919 and 25,000 in the spring of 1920. The executive officer of the Fish and Game Commission of the Territory of Hawaii, under date of December 20, 1921, reported as follows: "In the streams visited on Kauai which had been stocked, dozens of rainbow trout were seen in every pool. I have never seen more fish in virgin streams in the Cascade Mountains. The fish all have the appearance of being very fat and averaged about 10 inches." The bureau plans to send a further consignment of rainbow eggs to the islands this spring.

MANY LIONS SECURED IN GAME REFUGES.

Since the beginning of operations by the state lion hunter, 47 mountain lions have been killed in and around game refuges and 20 others in and around national parks. Eight lions have been killed in Fish and Game District 2A, five in Fish and Game District 3C, one in

Fish and Game District 3B, twelve in Fish and Game District 1E, and twenty-one in Fish and Game District 1I, on the three different trips into this refuge. Eight lions have been killed in and around Sequoia National Park and twelve in and around Yosemite.

COMMISSION FEEDS DEER AND QUAIL.

During February of this year the extreme cold weather caused much suffering among the wild birds and animals, especially among the quail and deer, in the higher altitudes of the state. Realizing the need for action in the matter, President Newbert of the Fish and Game Commission circulated through the newspapers the following letter:

"This is the time that tells the tale whether a man is just a meat hunter or a real red-blooded sportsman. It may be that many wild birds and animals are isolated in areas where it is impossible for our wardens to find them, owing to the deep snow. Nature teaches all wild life when in need to seek man and civilization.

"Therefore, residents of farms or towns are in a position to render aid by feeding these wild birds and animals. Our commission is more than willing to purchase feed to tide over these storms, and will authorize the expenditure of funds by our wardens.

"We ask all lovers of wild life to feed, temporarily at least, birds and animals until such time as our local deputy or district office may be notified."

The enthusiastic response to this letter, not only from the deputies and forest rangers but from many of the residents who fed numbers of birds and animals gratis, was very gratifying. In Plumas County about 150 head of deer were saved from starvation. In Siskiyou County several large flocks of quail were fed, one flock numbering 250. Fortunately no great loss has been reported, though the quail above the 2000-foot altitude were without feed for four days.

In Lassen County, deputies fed large numbers of quail and pheasants every day, as well as deer and antelope. The grain and hay used was furnished gratis by the people of the section. In Grass Valley the estimated number of quail cared for was 2500, and the number of deer about 400. Twelve hundred pounds of hay and 237 pounds of grain were fed at Indian Valley alone, the work requiring the assistance of several men, with teams, pack horses and mules.

REDDING DAM DISPUTE SETTLED.

The controversy regarding the installation of a fish ladder on the dam of the Anderson-Cottonwood Irrigation District at Redding has at last been settled. An injunction suit was brought by the commission against the irrigation district, and the case came up for trial on January 30, 1922, before Judge Herzniger of Redding.

The commission fully demonstrated that a suitable fishway had not been erected and that as a direct result thousands of salmon have found it impossible to reach their spawning grounds. But in order not to be too implacable in its attitude toward the irrigation district, which is already in financial troubles, the commission finally, on the fourth day of the trial, agreed to a settlement. The following agreement was signed by officials of the Anderson-Cottonwood Irrigation District and by the executive officer of the California Fish and Game Commission:

"The board of directors of the Anderson-Cottonwood Irrigation District and the people of the State of California, represented by the Board of State Fish and Game Commissioners, will cooperate, with and by the advice of the engineers of said district and the engineer of the State Fish and Game Commission, to use present facilities offered by the dam of said district for the purpose of passing salmon over said dam, to the end that the flow of water in the canal of said district shall not be impaired and the migration of salmon shall not be obstructed, and to that end the following recommendation is made:

1. Insert flash boards in the present fishway to check flow of water through the 12-foot space and from a pool below.
2. If this proves inadequate, insert flash board in vertical plane to perfect fishway.
3. If this proves inadequate, sink a timber box, 12 feet square, above the dam at the fishway to form an additional pool.

If it is found that said plan does not operate as a fishway for the free passage of salmon, then, and in that event, said district agrees to make such improvements on said dam as will adequately facilitate the passage of salmon over said dam, this being the intent and purpose of this agreement, and if any additional facilities for the passing of salmon over said dam are found necessary, should the proposed scheme prove inadequate for passing salmon over said dam, any further improvements made necessary shall be made with due regard to economy as well as to the other purposes to be accomplished herein.

(Signed) Anderson-Cottonwood Irrigation District; David Nelson, director; Charles H. Spann, director; W. F. Smith, director; Andrew Jessen, director; California Fish and Game Commission, Charles A. Vogelsang, chief executive officer."

As a result of the above agreement, a dismissal of the case was ordered by the superior court. Thus was ended one of the bitterest fights having to do with the conservation of salmon and the enforcement of the law relating to fishways.

MOUNT DOME ANTELOPE HERD.

The largest herd of antelope remaining in California makes its home at the south end of lower Klamath Lake, near Mount Dome. A recent census has shown that about 100 of these animals are to be found in this region. Because of the past hard winter these antelope were in need of additional food. The big game committee of the California Academy of Sciences, headed by Mr. M. Hall McAllister, became interested and furnished funds for the winter feeding of the herd. The accompanying photograph (Fig. 57) shows forty of the eighty-seven animals which came in to feed. The California Fish and Game Commission, the United States Forest Service, the California Academy of Sciences and other organizations are cooperating to give these antelope a maximum of protection. Several men have been deputized to watch for poachers and to see that the animals are properly cared for, and a move is now on foot to have a large area set aside as a permanent refuge for these antelope.

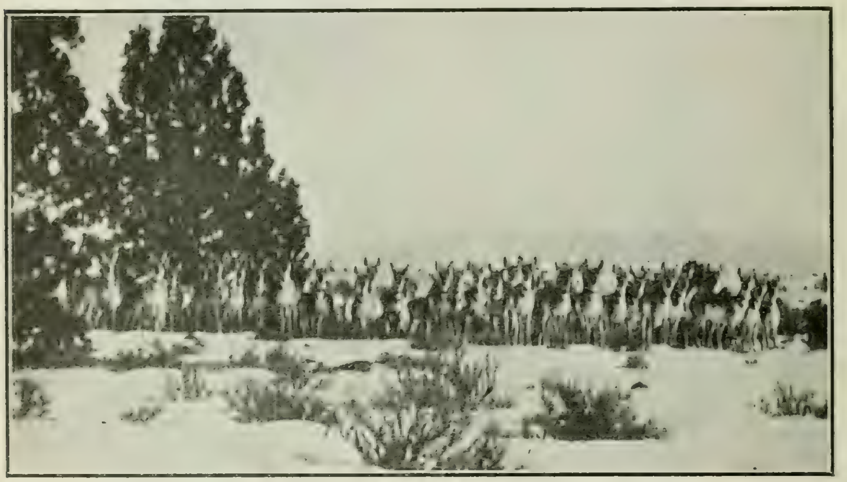

FIG 57. Antelope on the proposed Mount Dome Antelope Refuge. Photograph taken January 15, 1922, by J. O. Miller. About 40 antelope show in the picture.

COLD WEATHER KILLS PISMO CLAMS.

Subtropical fruits and vegetables are not the only things which may be killed or injured by cold weather in California. It has been reported to the State Fish and Game Commission by its deputy H. D. Becker that the recent cold snap has resulted in the killing of great numbers of Pismo clams, which in this instance may be compared with subtropical fruit, for they are a southern form and in San Luis Obispo County, where freezing was most noticeable, are near the northern limit of their range. Some clams, like the eastern soft shell which remains stationary in its hole in the mud, may be frozen almost solid and be no worse for the experience after thawing out, but it is not so with the Pismo clam.

Through investigations made for the Fish and Game Commission by Professor F. W. Weymouth of Stanford University, much has been learned of the growth and habits of this interesting and most important of California's clams. The young Pismo clams spend the first three years of their existence above the low-tide line, on gently sloping, sandy beaches. They are very active creatures and can bury themselves rapidly in the sand by means of their tongue-like "foot." And it is necessary that they be active, for the sand is continually moving in the surf, and in the wash of the waves during the flow of the tides up and down the beach they would be washed out and cast high on the beach if they did not dig rapidly.

During the recent cold spell these clams of tender age, being the young crop of the last three years and with shells not exceeding three inches in diameter, were so chilled or frozen during the few hours they were left exposed in the wet sand while the tide was out that they were unable to dig in with the flow of the tide, and were ignominiously cast high on the beach, where, with muscles too near frozen to keep their shells from gaping, they fell easy prey to the gulls and pelicans, which came from far and wide to the feast.

The damage to the young crop of clams has been very great. But, serious as is this loss, it is not nearly so serious as the destruction to these immature clams caused by summer visitors to our beaches digging them for food and sport in violation of the law, which prohibits their capture until they have developed shells 4¾ inches in diameter. It is unfortunate that the best beaches for Pismo clams are also our best pleasure beaches, where the people congregate in great numbers each summer. It is natural to dig in the sand, and if there is a prize to dig for, even if it be a very small clam, it seems to add fascination, and the chance of being caught by a game warden appears to lend excitement to the sport. Only once in the memory of the oldest inhabitant has extreme weather killed the young clams, but destruction of the young crop always exposed to thoughtless pleasure seekers takes place every year, and is far more serious.

The Fish and Game Commission has been warned by Professor Weymouth that destruction to the young crop of clams in violation of the law is more serious by far than the recent destruction by cold weather, or even the operations of professional clam diggers, at whom the local clam conservationists have been pointing their fingers. The matter is so serious that even the prohibiting of professional digging and the sale of clams may not save the Pismo clam from becoming extinct in California, unless the public learns the importance of protecting the undersized clams. Legal-sized clams can be found at extreme low tide, or, if one wishes really exciting sport, let him go into the surf after them with a clamming fork.

FISHERIES CONFERENCE MEETS AT SAN PEDRO.

In January the scientific staff of the California State Fisheries Laboratory at San Pedro held a conference to discuss the program which is designed to properly care for the fisheries of the State of California, particularly the great sardine fishery which has arisen within the last five years and which in 1919 produced 154,000,000 pounds of food fish.

So recent has been the origin of this great fishery that nothing is yet known about the permanence of its supply of fish. Fishes of the group to which the sardine belong show great fluctuations in abundance, at times being so scarce as to greatly limit the fishery for them, at others being in enormous abundance. The scientists of the State Fisheries Laboratory have planned their work to provide information concerning the possibility of such great and disastrous changes, which will be studied according to the most recent methods developed in Europe by the International Council for the Investigation of the Sea, and by Norway.

The program devised will also bring out the possibilities of depleting the fisheries by imposing too great a strain. It is not yet known whether the fisheries on the Pacific Coast are able to stand such strains as have been placed upon the Atlantic species of fish, but it is surmised that they can not. The sardine, as do other fishes, depends upon the food produced by waters near the shore, where certain natural elements necessary to the growth of their food are present. Along our coast this coastal water supply is decidedly limited compared to that found along the coasts of northern Europe, where the greatest fisheries have been carried on. It will be necessary, therefore, for the California Fish and Game Commission to exercise special vigilance to see that the supply is not exhausted by reckless use, such as the use of sardines for fertilizer in unlimited quantities. The observation of the supply is a matter for careful scientific observation by biologists, along lines similar to those indicated by the men in session at the laboratory.

But it has been necessary for the commission to do more than provide such a program of work, for it has become obvious that men specially trained for its execution are necessary. Since such men are not obtainable at the universities, the State Fisheries Laboratory has undertaken the training of students, who are later expected to finish college, where they are granted sufficient work and payment therefor to constitute a scholarship. The conference dealt with these matters, as well as the program of work.

This conference was held in the splendid new building recently completed for the scientific workers at San Pedro.

MARKET HUNTERS FIND WATCHFUL WARDENS.

The sale of ducks is now largely a thing of the past. Where the San Francisco markets formerly had 300,000 ducks, the illegal sale at present must be but a few hundred, or at most a few thousand birds. Of course, in spite of the federal law prohibiting the sale of ducks, the incentive of the dollar drives a number of men to continue each winter their former trade of market hunting. Automobiles and good roads make it possible for the duck bootlegger to continue to operate. But quick convictions and heavy fines have been meted out the past season, and the man who hunts for the market has to turn outlaw and smuggler.

The accompanying picture (Fig. 58) shows the destruction due to this type of hunting. Deputies of the commission heard night shooting near Willows on December 14, 1921, and investigated. The hunters ran, leaving a hat and "long gun" (an automatic capable of firing ten shots) and hundreds of ducks on the ground. After the birds had been collected, the photograph was taken.

Information withheld by residents of the duck country sometimes makes it difficult to make arrests. Deputies spend night after night in the cold, wet marshes, doing their utmost to stop market hunting, and yet those who could be most helpful in furnishing information refuse to aid. Proper information is often the most important part of gaining an arrest and conviction.

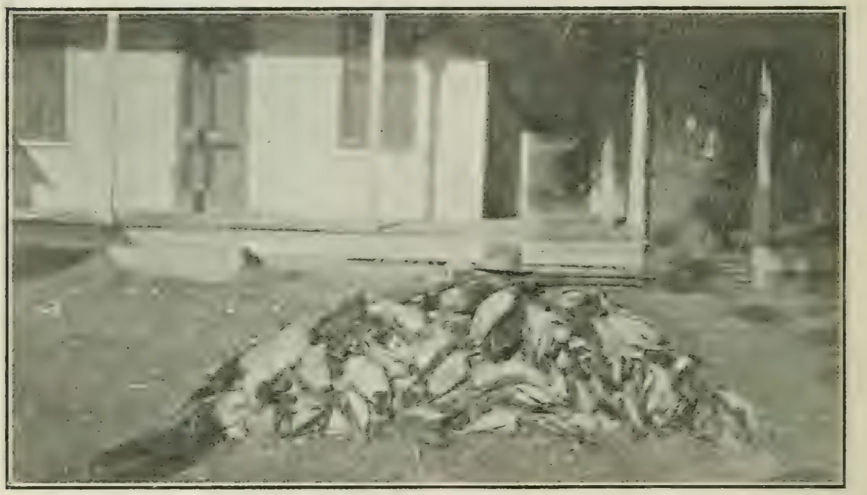

FIG. 58. Ducks seized near Willows on December 14, 1921, after night-shooters had abandoned their kill at the approach of Fish and Game Wardens.

FAULT FOUND WITH THE PUBLIC SHOOTING GROUNDS BILL.

The New-Anthony bill providing for a federal license to hunt migratory birds and for the establishment of public shooting grounds and game refuges, which has been widely endorsed by sportsmen's organizations and game commissions, was not all that it was made to appear to be in the publicity given it. By a provision almost hidden in the text there is unwarranted encroachment by the federal government on the rights of states. Section 13 provides for complete control of every "fish, wild animal, or wild bird," whether it be resident or migratory. Judging by court decisions, this is unconstitutional. Furthermore, the bill provides for administration by a commission composed of the Secretary of Agriculture as chairman, the Attorney General, the Postmaster General and two members from each house in Congress. How are the sportsmen represented on such a committee? Worse, the commission is purely political and has the power to spend millions of the sportsmen's money. Any law of this kind should be administered by a commission made up of conservation experts.

It was the fish and game commissioners of the Western states that discovered the flaws in the bill and made the first important protest. A convention was held at Salt Lake City and the following resolutions were passed:

A RESOLUTION

Adopted by the Western Association of State Game Commissioners January 17, 1922.

The several commissioners and game wardens of the game and fish departments of the states of Arizona, Colorado, Montana, New Mexico, Oregon, Utah and Wyoming, in conference assembled at Salt Lake City, Utah, this seventeenth day of January, 1922, having carefully considered United States Senate Bill No. 1452, entitled "The Federal Public Shooting Ground and Game Refuge Act," do unanimously adopt the following resolutions:

WHEREAS, We appreciate the need for the establishment of public shooting grounds and game refuges in various parts of the United States, for the benefit of the public at large and for the protection of migratory birds; and

WHEREAS, We, through our several game and fish departments in the states which we represent, have given our full support and cooperation to the efforts of the federal government to successfully administer the present federal migratory bird laws and regulations; and

WHEREAS, We approve of the purpose and aims of the federal government as evidenced by the present migratory bird laws and are in favor of such additional legislation as may further such purpose; and

WHEREAS, On the other hand, we are not unmindful of the inherent sovereignty of the several states as recognized in the decision of the Supreme Court of the United States in its determination that the game and fish within the confines of each state are the property of such state and, therefore, under the jurisdiction and control of state authority; and

WHEREAS, We disapprove of the centralization of control in the federal government, of the game birds, animals and fishes which find their range within the confines of any state; and

WHEREAS, The purport of said Senate Bill No. 1452 is not, in our opinion, as indicated in its title, but, on the contrary, is designed to, and will result in, an unwarranted encroachment by the federal government upon the rights of the various states in the protection of their fish and game, and in the administration of their fish and game laws; now, therefore, be it

Resolved, That we protest against the enactment into law of United States Senate Bill No. 1452 for the reasons as set forth in the foregoing preambles and more specifically because:

1. Said Senate bill, although in its title "providing for establishing shooting grounds for the public; for establishing game refuges and breeding grounds; for protecting migratory birds and requiring a federal license to hunt them," nevertheless, in the body thereof, purports to give authority in nowise indicated in the title, and delegates power to the Department of Agriculture and a committee consisting of the Secretary of Agriculture, the Attorney General, the Postmaster General, two members of the Senate and two members of the House of Representatives, giving said commission complete legislative powers to make rules and regulations which will have the force of laws governing and controlling, not only the migratory birds and the game animals, but also the fishes that may be found in their natural state or introduced into any of the lands or waters upon any game preserve secured under said act, either by gift, lease or purchase.
2. We do not approve of creating a federal organization of game wardens which, in the enforcement of said act, will largely duplicate the work of the state organizations for the protection of fish and game, thereby increasing the operating expenses necessary to the enforcement of the law, and tending to create conflicting authority between state and federal game wardens and to disrupt the harmony and unity of purpose now existing between the state and federal departments.
3. We object to the federal government assessing a license fee against citizens of a state for the privilege of hunting and fishing within the confines of his own state.

AND WHEREAS, We believe that the enforcement of the migratory bird law is of sufficient importance to justify a direct appropriation from Congress for that purpose; be it further

Resolved, That we favor a direct appropriation from Congress for the purpose of enforcing the Migratory Bird Treaty Act and the establishment of public shooting grounds and game refuges under the direction of the Biological Survey.

It has been determined to express the foregoing ideas in resolution form for the purpose of conveying to the Congress of the United States a concrete expression by the fish and game officials of the above named states who are primarily interested in legislation, be it state or federal, which will be most suitably designed to accomplish the protection and increase of the fish and game of the country and to avoid submerging a laudable common purpose, in disputes and conflicts (intensified possibly by a sense of unjust assumption of federal control) between officials and employees of departments of government with overlapping coordinate authority.

J. W. TINGEY, Secretary.
D. H. MADSEN, President.

The original bill thus exposed should have no chance of passing, but strange things happen, and if sportsmen and conservationists remain apathetic, states will be robbed of their rights and sportsmen's license money exploited by a political commission. The California Fish and Game Commission has now refused to support the bill unless it is suitably amended, and California representatives in Congress have been so informed.

DEER HUNTERS SHOOT CATTLE.

In our January issue a long list of hunting accidents furnished evidence that many hunters are careless when in the field and fail to "look before they shoot." Now comes additional evidence of like carelessness in a report of the United States Forest Service, which states that on eight of the national forests of this state sixty-four cattle and three horses met death from hunters' bullets during the last open season. And this killing of animals is but one of the just complaints of the cattleman. Some hunters, neglectful of others' interests, break down fences and leave gates open. Furthermore, in late summer, campers often usurp the only watering place for miles around and continually drive the cattle away, to finally die for lack of water. Unless hunters take some steps to correct these evils themselves, it is certain that the men financially concerned will be instrumental in further curtailing the hunter, and the careful will be made to suffer with the careless.

EDUCATIONAL WORK IN YOSEMITE TO CONTINUE.

At the request of the National Park Service, the Fish and Game Commission will again cooperate in educational work in the Yosemite National Park this coming summer. As in past years, the incidental expenses and the expense of assistants will be assumed by the National Park Service. Last year over 31,000 persons received instructions through the medium of lectures, and over 2000 persons were taken afield and given first-hand information regarding wild life.

The California Nature Study League, which has been greatly interested in the project, recently sent the following letter to President Newbert:

Mr. Frank Newbert,
President California Fish and Game Commission.
Sacramento, California.

My dear Mr. Newbert:

On behalf of the California Nature Study League, may I thank you for the Fish and Game Commission's continued conduct of the educational work at Yosemite National Park? There is probably no money expended by the State of California that will eventually bring bigger dividends to the taxpayers than such educational work.

The last time I was leaving Yosemite I happened to meet on the train a group of people from San Mateo County. One of the children, a girl of about eleven, had been tested in the mental tests at Stanford University. She ranked so high that the professor declared she was about one in a million. In other words, there were only about 110 people in the United States, adults and children, as bright as this girl. In other words, she will be a genius of the tomorrow. She had had training along other lines, as literature and art, but her first stimulus to scientific education was through the work of Dr. Bryant of your staff.

Just what may come of this you and I will probably never know. We will probably both be old men if we even live to see the fruiting of that intellect. Does it not show dramatically, however, the tremendous possibilities of the wild-life conservation work which your commission is doing?

Sincerely,
(Signed) C. M. Goethe, President.
California Nature Study League.

STANFORD PLANS ANIMAL REFUGE.

If the plans of the Zoological Club at Stanford University are successful the 800 acres comprising the Stanford Farm will become a state game refuge. The Zoological Club has offered to furnish the labor necessary for making and posting signs and to render all possible aid in detecting and reporting violators of the refuge. Illegal hunting and wanton killing by people from off the campus has stimulated this move to carefully conserve all the animal life of the university holdings.

BIG GAME IN SWEDEN.

Moose are to be found in many of the central and northern provinces of Sweden and are being conserved and protected in spite of open hunting grounds and the absence of artificial game regulations which are so common in other European countries. The open season is two weeks in September, and each permittee is allowed to take one cow and one bull. There is no general license system; the hunter may procure a license from the state for hunting on state lands, or, if hunting on private lands, a permit may sometimes be obtained from the owner; in either case the cost of the license is much greater than the cost of the American license.

The following table shows the number of moose killed in different parts of Sweden during the year 1919, as reported by forest supervisors and rangers of the Swedish Forest Service:

Number Killed During the Two Weeks Open Season.

Bulls	791	
Cows	580	
Calves	7	
Sex not given	31	
Total		1509

Number Killed During Closed Season.

Bulls	22	
Cows	12	
Calves	4	
Sex not given	80	
Total		118
Total killed during year		1627

(From Sveriges officiella statistick Utdrag ur revirbersattcheruas uppgifter.)

In general, the reports show that the moose are decreasing, due to excessive hunting during the years of crisis. A closed season for several years is contemplated.—G. W. Hult, San Francisco, California.

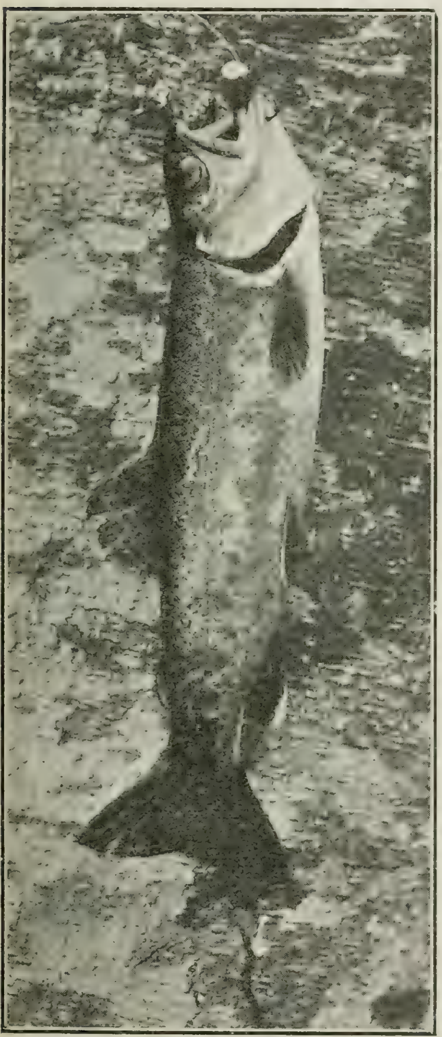

Fig. 59. Rainbow trout caught on San Joaquin River and photographed by A. A. Rohde.

A PHOTOGRAPH OF A RAINBOW TROUT.

Since clear, detailed photographs of fish are often difficult to obtain, we are publishing herewith a successful picture of a rainbow trout secured by Mr. A. A. Rohde of Fresno, California, taken near Bass Lake, Madera County, on the San Joaquin River (Fig. 59). Mr. Rohde took this picture with the fish two feet from the camera, using a Ray color filter over the lens and a 5 by 7 plate. The trout weighed 3 pounds and was 8 inches in length.

DANGER TO FISHERIES FROM OIL AND TAR POLLUTION OF WATERS.

In the report of the United States Commissioner of Fisheries for 1921, Mr. J. S. Gutsell discusses at some length the danger to fisheries from oil and tar pollution of waters. He points out that three main sources of oil and tar pollution have been found: Road washings, carrying great quantities of lubricating oil; gas houses and oil refineries; tankers, oil burners and oil-engined shipping. Tars, tar oils and crude distillery products are found generally to be highly poisonous, whether in weak or great dilution. Some oils have been found to emulsify to a sufficient degree, with continued agitation, to coat the gills of fish and so produce death by suffocation. An oil film, through prevention or checking of aeration, is dangerous, particularly in busy harbors. The deleterious effect on spawning, by rendering spawning grounds unfit or inaccessible, is a grave danger arising from the pollution of harbors and streams. Another serious danger is found to lie in the possible effects on the diminution of the food supply. Through whatever means, it is an observed fact, according to Weigelt, that in Germany fish have completely disappeared from pools and ponds following the discharge of mineral oils into the water. In the sea a great danger is suggested by the fact that the eggs of sea fishes are typically floating, and that oil-burning and oil-engined shipping is greatly increasing.

Remedial measures may (now or in the future) be found: (1) In the recovery of oils from drainage water, as already has been proposed; (2) in the prevention of gas-house and refinery pollution, which prevention should be helped by the increased use of "wastes" in by-products;

and (3) in prevention, by international arrangements, of the dumping of oil from ships in harbors or in the region of spawning grounds or special feeding areas.

FISH COOKERY.

"The last word on fish cookery" has just been given to the public by Messrs. Little, Brown & Company of Boston, in a volume on "Fish Cookery" by Evelene Spencer and John N. Cobb. Mrs. Spencer, after spending much time demonstrating fish cookery in the city of Portland, Oregon, in connection with its municipal fish market, was engaged by the government during the "Eat More Fish" campaign, to travel through the country, explaining the food value of fish and the desirability of using the less familiar species, illustrating her lectures by various methods of cooking this food.

Mr. Cobb, the co-author, is director of the College of Fisheries, University of Washington, Seattle, and the author of numerous works on the fisheries. He has contributed valuable information as to the fish themselves, and tables as to their food value, their location, seasons, etc.

The book contains more than 600 recipes for cooking fish and its accompanying sauces and dressings. Every conceivable manner of serving fish is described, treating not only the subject of the common and well known varieties, but numerous little-known and seldom used varieties as well, which contain equally valuable food properties. This last word on fish cookery should serve to bring that little appreciated branch of the art into its proper place in the preparation of a well-balanced menu.

UNITED STATES TOPOGRAPHIC MAPS.

Every hunter and fisherman who goes to the mountains should carry with him a United States topographic map. From these maps he may obtain information relative to streams, lakes, springs, elevations, and even cabins and other civilized institutions. There are few states where so much use is made of unsettled districts as in our state, and it is quite important that all areas open to the summer vacationist should be properly mapped. At the present time one may secure suitable topographic maps of almost any area on the desert and in the Sierra, and one may travel from the Mexican line as far north as Point Reyes utilizing a government map. The area to the north of Point Reyes, however, is still unmapped, although much used as a recreation ground. A little pressure brought to bear on the United States Geological Survey would assure the completion of the series of maps now available.

FACTS OF CURRENT INTEREST.

The California fisheries production for 1921 was 123,192,193 pounds of fish and 5,310,251 pounds of shellfish, making a total of 128,502,444 pounds. The total production for 1920 was 213,847,825 pounds.

* * *

With the increased rainfall the past year has come a splendid run of steelhead trout in the coastal streams.

* * *

The 1921 sardine catch was 59,332,305 pounds, which was only one-half as large as the 1920 catch.

* * *

The principal decrease in the fish catch noted in 1921 was of varieties used for packing purposes. Of the 128,502,444 pounds of fish and mollusks taken in California during 1921, approximately 66 per cent was used for canning and packing purposes, 30 per cent was used in a fresh state, and the remaining 4 per cent consisted of mollusks and crustaceans.

* * *

The salmon catch in California in 1919 was 13,145,727 pounds; in 1920, 11,133,819 pounds, and in 1921 it was only 7,990,932 pounds. A decreased catch is shown in all the salmon-fishing districts of the state.

* * *

Severe weather during February necessitated the feeding of quail and deer in many sections to prevent their starvation.

* * *

Spawning operations for the past season have been fairly successful considering the severe weather. A good take of eggs is assured.

* * *

Computation shows that the California Fish and Game Commission has planted more than 1,128,800,000 fish in the streams and lakes of this state.

COMMERCIAL FISHERY NOTES.

N. B. Scofield, Editor.

CHICAGO, MINNEAPOLIS AND ST. PAUL AS FRESH FISH MARKETS.

The United States Bureau of Fisheries has just issued an economic circular entitled "Trade in Fresh and Frozen Fishery Products and Related Marketing Considerations in Chicago, Illinois," and another with a similar title but for the twin cities, Minneapolis and St. Paul. These circulars are by L. F. Hopkinson, agent of the bureau. The reports are quite complete and of great interest to all who may be interested in the marketing of fresh and frozen fish.

Chicago gets its fresh fish supply principally from Canada, the Great Lakes and the north Pacific Coast. A million and a quarter pounds of ciscoes, chubs and yellow perch were landed by Chicago commercial fishermen fishing in Lake Michigan during the last fiscal year. With the exception of halibut and salmon from the Pacific Coast and shucked oysters from the Atlantic Coast, the consumers prefer fresh water varieties. Seventy per cent of the fish trade is confined to eleven species, as follows: Buffalo-fish, carp, ciscoes, halibut, lake trout, pike or "jacks," salmon, whitefish, yellow-perch, yellow-pike and shucked oysters.

It is interesting to note that the two principal varieties consumed are the carp and a fish closely related to it, the buffalo-fish. The buffalo-fish come from Minnesota, Illinois River, Mississippi River and other nearby rivers, and are shipped to market "in the round" in 100- to 150-pound boxes and in barrels of 200 pounds each. The carp come from the same source and from the Great Lakes. They are shipped both "in the round" and dressed, in boxes and barrels. Shad are popular during season, but the supply, coming from Baltimore, Md., New York, N. Y., Florida and California, is limited.

Fish arrive in Chicago mostly in carload lots, both fresh and frozen. During the year ending July 31, 1921, a total of 526 carloads was received from Canada, as against 272 from the United States. During the same year a total of 19,643,047 pounds of frozen fish was placed in Chicago public cold-storage warehouses, while 20,104,072 pounds were withdrawn during the same period, there being a little over 7,000,000 pounds held over from the previous fiscal year.

The Bureau of Fisheries has also issued economic circulars setting forth the results of similar fish-market surveys in the cities of Louisville, Ky., and Pittsburg, Pa.

COLD STORAGE FISH.

Apparently there is very little prejudice in Chicago against cold storage fish, and that is as it should be, for it has been shown by investigations of federal bureaus that if fish are frozen soon after landing them from the fishing boats they can be kept frozen for several months in cold storage houses and still reach the consumer in better condition than if delivered direct without freezing.

Very nearly all kinds of fish have their seasons of greatest abundance followed by a period of scarcity. To freeze the fish at times when they are abundant and the markets oversupplied, and carry them over into the period of scarcity, increases their consumption and prevents the dumping of fish which so often happens on account of an oversupply of the market. The fishermen also would get a more nearly just reward for their labor and the public would get its fish at a less price.

The greatest need in the fresh fish industry in California is undoubtedly better freezing and cold storage facilities at the fishing centers. Such plants are being installed very slowly. What is needed to hasten the movement is to convince the public that the fish reach them in better condition if frozen immediately after catching. It will be necessary, however, to freeze the fish immediately after catching, and not after a few days' waiting to find a market, as it must be admitted there is a temptation to do.

CALIFORNIA SARDINES CONSIDERED HERRING BY CHILEAN CUSTOMS OFFICIALS.

The Fish and Game Commission's attention has been called to the fact that the customs authorities of Chile have ruled that California "pound oval" sardines are herring, and propose to collect the $1.20 per kilo herring rate on importations from California, instead of the 30 cents per kilo sardine rate to which our canners claim they are entitled. The higher herring rate of $1.20 per kilo, California canners say, will make shipment of our sardines to Chile impossible.

The California sardine is a true sardine scarcely to be distinguished from the sardine of Europe, and should not be confused with the species of herring which are being canned in other places and labeled as sardines. The scientific status of the California sardine and its relation to the other species of sardines and "sardine herrings" is set forth by Mr. Will F. Thompson in the October, 1921, issue of this magazine, in an article entitled "The Sardine of California." It is there shown very clearly that the California sardine (*Sardina coerulea*) is a true sardine. An article to the same effect by Professor E. C. Starks of Stanford University appeared in the April, 1918, number of this magazine.

The Fish and Game Commission is taking the matter up with the Chilean authorities, with the hope that they will give our fish the proper designation of "sardine." At the request of some canners the commission has issued a certificate to the effect that our fish are true sardines and not herring.

WORK OF THE CALIFORNIA LABORATORY OF THE BUREAU OF FISHERIES.

During the past fiscal year, while the Bureau of Fisheries' experimental laboratory at San Pedro was being operated by the Fish and Game Commission, investigations were carried on to determine what changes take place in the "fry bath" oil used for frying sardines. A report on this work is being published by the commission (circular No. 1).

In frying the large sardines for packing in pound cans, as it is practiced in the industry, the fry-bath oil quickly becomes dark in color and imparts a distinct and not altogether agreeable flavor to the sardines being fried. This oil has to be frequently discarded, and on that account contributes very materially to the expense of canning. It was therefore the object of the work at the bureau's laboratory to find some way, if possible, to purify and reclaim this oil and find out what changes caused the peculiar odor and taste in the oil and to devise some way to remedy it.

Several different oils have been used by the industry for frying the sardines, but cottonseed oil is the one commonly used. In the experiments it was found that corn oil or a hydrogenated oil does equally as well. In regard to the changes which take place in this fry oil, it was found that when fat sardines are fried—and the larger sardines are usually fat—the fry oil in a very short time becomes largely sardine oil. It is the presence of sardine oil in the fry bath which causes most of the trouble it was sought to correct. Sardine oil becomes easily oxidized by heat and contact with the air, and it is oxidized sardine oil which imparts the slight odor and taste to the canned product. No way was found to prevent the sardine oil from getting into the fry oil, and no economical means was found of purifying and reclaiming the fry oil or of preventing the oxidation of the sardine oil in the process of frying. The investigator, Mr. Beard, considers it improbable that any cheap successful means will be found.

The negative results of the experiments in purifying and reclaiming the fry-bath oil forced Mr. Beard to the conclusion that the best way to avoid the disagreeable taste imparted to the sardines and to lessen the cost of packing was to eliminate the process of frying in oil. The work of the laboratory during the present fiscal year has been largely devoted to methods of packing sardines in which oil frying has been eliminated. In these experiments the sardines were precooked in steam and in boiling brine, and they were also packed without precooking. It is believed that a method has been found which will lessen the cost of packing and at the same time result in a better pack, one which will be more palatable and digestible, and will "stand up" in shipping as well or better than the "fried in oil" pack.

The Bureau of Fisheries laboratory has issued pamphlets to California canners describing this method, and sample cans will be furnished to canners if they are interested. The results were given immediately to the canners, so that they might try out the method during the present season.

The California sardine is a very excellent fish and deserves a high place among the canned foods of the United States. It seems necessary, however, that improvements be made in the pound oval pack and that an organized publicity campaign be launched if the California sardine is to win the place in the minds of the people of the United States which it deserves.

LIFE HISTORY NOTES.

LARGE MACKINAW CAUGHT IN DONNER LAKE.

Anglers in the Truckee basin continue to occasionally catch the mackinaw trout (*Cristovomer namaycush*). On July 26, 1921, Mr. W. B. Gelatt caught a 12-pound mackinaw trout in Donner Lake, using minnow chubs for bait.

The mackinaw trout was first planted in Lake Tahoe in 1895, and a year later in Donner and other nearby lakes, after the successful hatching of a shipment of eggs.

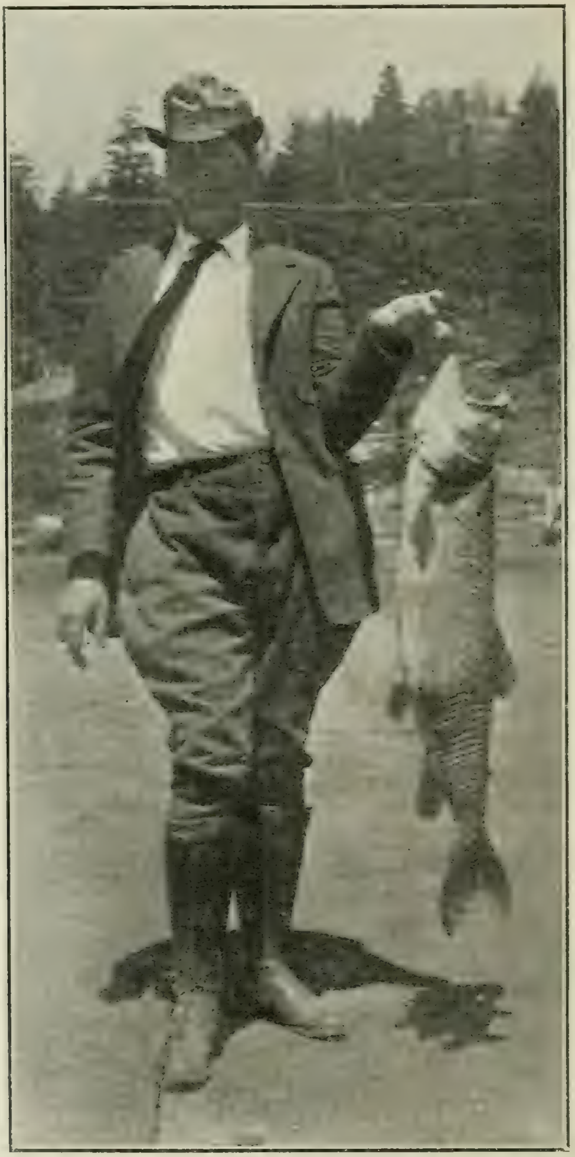

FIG. 60. Mackinaw trout, weighing 12 pounds, caught July 26, 1921, in Donner Lake by W. B. Gelatt. Mackinaw trout was introduced into the waters of this lake in 1895, but the annual catch is very small.

Although fish of this species are occasionally caught in lakes of the Truckee basin, the mackinaw, or Great Lakes trout, as it is sometimes called, has never thrived to the extent expected when introduced into this part of the country. This season, however, an unusual amount of large trout, ranging from 5 to 15 pounds, have been caught in Donner Lake.—GEORGE NEALE, Sacramento California.

WHITE PELICANS MEET DEATH DURING COLD WAVE.

Investigation authenticated a report in late January that numerous white pelicans were found dead on the shores of Lake Washington, near Sacramento. Local observers stated that the extremely stormy weather was responsible for the death of the pelicans. The terrific north wind appeared to render the birds helpless, and many were unable to rise after being blown down on the ice, which was several inches thick, or against wires. After the storm more than twenty-five of the pelicans were found dead along the shore of the lake.—GEORGE NEALE, Sacramento, California.

CONSERVATION IN OTHER STATES.

OREGON KILLS SEA LIONS.

During the past year the Oregon Fish Commission at the request of commercial fishermen, has attempted to exterminate the Stellar sea lions in the colonies along the Oregon coast. For this purpose a special boat was secured and equipped. The slaughter of these mammals is defended on the claim of the fishermen that the sea lions destroy large numbers of young salmon. It is to be hoped that the stomach contents of the animals killed is being carefully analyzed, for when an investigation was ordered a number of years ago here in California, on the complaint of fishermen, the sea lions killed were found to contain squids and octopi rather than salmon.

CONSERVATION IN EDUCATION.

"Education is perhaps the greatest one factor in aiding conservation. Undoubtedly the teaching of the principles of wild-life protection in the public schools will have a wonderful restraining effect upon the coming generation. The Wisconsin Game Protective Association is endeavoring to have a law enacted providing that Wisconsin school children shall be given instruction in the conservation of fish and game as a part of their regular school courses.

An effort should be made in all states by sportsmen's associations to have laws of this nature passed. At the present time Nevada is the only state we know of that has a law requiring that conservation be taught in the public schools of that state." — (R. P. Holland, Field and Stream, May, 1921, Vol. 26, No. 1, p. 33.)

OREGON HAS ADOPTED NEW GAME CODE.

At the last session of its legislature the State of Oregon adopted a new game code, the outstanding feature of which is the increase in license fees for both hunting and angling to $3, with the provision that a combination hunter's license and angler's license may be obtained for $5. With the increased income from license fees the commission expects to improve its patrol service and to increase its hatcheries from five to fourteen.

WISCONSIN'S BUCK LAW FAULTY.

Wisconsin is unfortunate in the wording of her new buck law, which provides that only bucks not less than one year of age can be lawfully taken. As a result sportsmen are continually writing the Conservation Commission. asking for some means of identifying a year-old buck deer. In that according to law a deer can not lawfully be killed until it is one and one-half years old, since fawns are born in May and June, the Conservation Commission has recently instructed its wardens that all deer with horns less than 3 inches in length, found in the possession of a hunter, are fawns and are to be confiscated. An attempt will be made to amend the law at the next legislative session to provide for a certain length of horn.

AUSTRALIA ESTABLISHES REFUGE.

The establishment of Wilson's Promontory, a national sanctuary in Australia covering about 101,000 acres of mountainous country, will provide protection for many birds and become the last refuge for the Lyrebird, which has been so persecuted by the plume-hunter, the egg-collector and the fox.

NATURE PROTECTION IN JAPAN.

Japan is directing her attention very seriously to the protection of her animal life. Certain animals peculiar to Japan are in grave danger of extermination. Such are the Japanese ibis, Japanese egret, the Siberian bustard and the spoonbill. The Ministry of the Interior of the Empire of Japan has issued a brochure containing a list of the monuments, ruins, sites and places, and of the animal life, which it is desired to protect. — Bird Notes and News, Vol. IX, p. 53.

NEW MEXICO HAS NEW GAME LAWS.

At the last session of the New Mexico legislature the game laws were completely revised and a new commission appointed. The commission is composed of three members, not more than two of whom shall be of the same political party, appointed by the governor. The terms are for six years and are overlapping, so as to assure continuity of policy. The commissioners serve without pay. The chief warden is also appointed by the governor.

The commission is granted regulative powers in addition to those of law enforcement. The new law describes the various functions as follows:

To establish game refuges for the purpose of providing safe sanctuaries in which game may breed and replenish adjacent hunting ranges.

To declare closed seasons in any specified locality on any species of game or fish threatened with undue depletion from any cause.

To purchase land for game refuges and public hunting grounds, particularly suitable for waterfowl hunting.

To designate resting grounds for waterfowl, in which they shall not be molested.

To close waters to fishing, for the protection of recently stocked streams, spawning waters or depleted waters.

To establish fish hatcheries.

To prohibit hunting in periods of extreme forest-fire danger.

To propagate, purchase and sell game animals, birds and fish for restocking.

To withhold license privileges for not to exceed two years from any person procuring a license through misrepresentation or hunting without a license.

The commission is not authorized to open any closed season established by the legislature, to lengthen any open season, to declare a closed season on any predatory species, or to increase any bag limit.

GAME CONDITIONS IN BRITISH COLUMBIA.

A report of game conditions for 1920 by the Game Conservation Board of British Columbia chronicles several changes in the game laws in an endeavor to better conserve game. In northern British Columbia the bag limit on mountain sheep has been reduced to two rams of any one species or three in all. In the southern part of the province only one ram may be killed. Wapiti are being given a closed season in southern British Columbia. Sentiment favoring a buck law is gaining ground rapidly. Even the grizzly bear is being accorded a measure of protection, being entirely protected south of the main lines of the Canadian Pacific Railway, and a bag limit of three being allowed for the region lying to the north. As might be expected, the catch of fur was comparatively small, the 1842 trappers reporting a take of 110,573 pelts.

REPORTS.

STATEMENT OF EXPENDITURES.

Period July 1, 1921, to December 31, 1921.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			$563 33		$563 33
Executive offices	$434 54	$9,376 43	2,931 56	$12 00	12,754 53
Printing			4,212 30		4,212 30
Research and publicity	242 00	2,050 00	384 01		2,676 01
Accident and death claims			11 28		11 28
Department totals	$676 54	$11,426 43	$8,103 48	$12 00	$20,217 45
Commercial fish culture and conservation:					
Superintendence	$282 76	$5,047 50	$2,711 20	$378 21	$8,419 67
Inspection and patrol	2,434 21	10,290 00	2,297 09	33 90	15,055 20
Research	524 20	9,832 67	2,796 19	1,772 28	14,925 34
State laboratory construction	12,779 72	9,855 77	373 32		23,008 81
Statistics	398 00	3,849 49	152 39	184 15	4,584 03
Market fishing license commissions			320 00		320 00
Propagation and distribution of salmon	4,591 14	10,840 12	1,438 42	765 30	17,634 98
Department totals	$21,010 03	$49,715 55	$10,088 61	$3,133 84	$83,948 03
Sporting fish culture and conservation:					
Superintendence	$415 58	$6,410 41	$17,824 93	$28 05	$24,678 97
General patrol (40 per cent)	356 35	25,686 57	18,711 20	3 88	44,758 00
Propagation and distribution of trout	21,325 55	33,922 48	20,627 43	5,321 39	81,196 85
Department totals	$22,097 48	$66,019 46	$57,163 56	$5,353 32	$150,633 82
Game conservation:					
General patrol (60 per cent)	$559 13	$38,819 50	$46,438 04	$5 82	$85,822 49
Tahoe camping ground	$14 55	$603 00	$14 75	$2 50	$634 80
Grand totals	$44,357 73	$166,583 94	$121,807 44	$8,507 48	$341,256 59

Seizures.

Game.

Deer meat	281½ pounds
Deer, ———	5
Deer	751 pounds
Deer and valley quail	34 pounds
Valley quail	93
Ducks	1,612
Geese	38
Golden plover	1
Spike buck	2
Wild pheasants	3
Meadow larks	7
Swan	1
Sage hens	19
Shore birds	8

Fish.

Abalones	508
Dried abalones	41 pounds
Brant	9 pounds
Bass, black and striped	38
Bass, striped	643½ pounds
Clams	324
Crabs	191
Crab meat	14 pounds
Crawfish	1
Halibut	200 pounds
Croaker—yellowfin	300 pounds
Lobsters	841
Salmon	29
Smelt	75 pounds
Trout	17
Trout	66 pounds
Trout, smoked	50 and 2 boxes

Illegal nets	13	$1,235 00

Searches.

Game	7

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1921.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Glenn, Tehama, Colusa	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego	Imperial	Total	Mexican, brought into California
Albacore												520,411				520,411	
Anchovies								33,295		7,400		1,000		1,000		42,695	
Barracuda								71			68,432	98,461		91,559		258,523	1,159,017
Bluefish									7,528	17,138						24,666	
Boccaccio								5,227	37,927	176,523	4,415					224,092	
Bonito									7	7	7,362	83,199		10,019		100,594	56,936
Carp				340		5,592	831									6,763	
Catfish		41,880				1,381										43,261	
Chilipepper								933	100,172	50,001						151,106	
Cultus Cod	215		116					61,334	4,503	56,539				890		123,597	
Dolphin																	
Eels																	
Flounders	2,480		10	302			983	51,375	12,125	1,298		1,619		640		70,832	773
Grayfish							377	26,507	774	20	800			13,402		41,880	
Greenfish																	
Hake								22,120	7,150							29,270	
Halibut	1,350							11,624	1,394	986	48,099	84,477	232	49,210		197,372	373,927
Hardhead						13,784	38									13,822	
Herring	2,192		7,133				4,837	53,188								67,350	
Kingfish								150	10,527	6,061	565	64,082		1,580		82,965	905
Mackerel									129	67,330	28,136	648,894	6,195	32,220		782,904	27,815
Marlin																	
Mullet														4,942	288	5,230	4,145
Perch	3,667		3,210				13	19,567	23	780		25,556	336	459		53,611	6,527
Pike				32		637	1,753									2,422	
Pompano								2,057		42	15	4,409				6,523	
Rock Bass											37	54,864	1,026	7,489		63,416	2,564
Rockfish	257							163,760	90,779	197,236	21,161	239,816	12,045	104,813		829,867	16,351
Sablefish								53,938	63,439	6,007						123,384	
Salmon	367,069		833	10,076		8,912	2,332	218								389,440	
Sandabs								150,740	41,150	160		2,885				194,935	
Sardines								94,602	1,269,315	14,237,919	2,000	14,206		373,076		15,991,118	
Sculpin												13,851		2,642		16,493	
Sea Bass—Black											2,190	5,227		18,874		26,291	13,488
Sea Bass—White								14,641	1,626	18	11,604	89,678	192	20,428		138,187	201,796
Sea Trout											500	15	2,033	135		2,683	3,400
Shad				1,796		2,155	19,903	23								23,877	
Shad—Buck				155			10									165	
Shad—Roe																	

Sheepshead											53	1,263		2,601		3,917	
Skates								18,253	1,500	240		475	25			20,493	
Skipjack									95			56,256				56,351	
Smelt	9,212		5,059					14,659	3,692	30,500	6,439	52,042	109,088	8,859		239,550	7,304
Sole								1,224,916	275,911	2,375	1,767	10,418	7	3,386		1,518,780	537
Splittail						440	49									489	
Striped Bass			117	18,661		15,505	119,233	339								153,855	
Stingaree														1,215		1,215	
Suckers						2,097										2,097	
Surf Fish																	
Swordfish												733				733	
Tomcod								6,257	1,950							8 207	
Trout—Farm																	
Trout—Steelhead	3,605															3,605	
Tuna												88,380		3,082		91,462	115,695
Tuna—Bluefin												55,357				55,357	
Tuna—Yellowfin												22,419				22,419	31,458
Turbot																	
Whitebait								1,835								1,835	
Whitefish												7,130		1,139		8,269	200
Yellowtail											627	613,716	188	255,732		870,263	211,705
Miscellaneous	15						151	31,785	8,092	3,752	11,553	16,860		5,258		77,466	2,267
Total fish	390,062	41,880	16,478	31,362		50,503	150,510	2,063,414	1,939,808	14,862,332	215,755	2,877,699	131,367	1,014,650	288	23,786,108	2,236,810
Crustaceans:																	
Crabs (doz.)	622	75	306				13	13,886								14,902	
Ecrevisse (doz.)																	
Shrimps			111,064				44,467	94,926				671				251,128	30
Spiny Lobsters											32,923	121,087	5,388	108,379		267,777	241,812
Mollusks:																	
Abalones										264,590	4,362					268,952	
Clams—Cockle	1,210		1,017													2,227	
Clams—Mixed	5,069		8,254				1,305									14,628	
Clams—Pismo									405		30,556					30,961	
Clams—Softshell		279	13,361				25,567	12,305								51,512	
Cuttlefish								1,420	283	12,821		156				14,680	
Limpets																	
Mussels							636	389		2,825	40					3,890	
Oysters—Eastern (No.)			1,185,310													1,185,310	
Oysters—Native																	
Snails																	
Squid										80,422		2,838				83,260	
Miscellaneous:																	
Frogs (doz.)																	
Terrapins (doz.)																	
Turtles										75		160				235	440

All amounts shown in pounds unless otherwise specified. Albacore and Skipjack cleaned. All other fish in round.

VIOLATIONS OF FISH AND GAME LAWS,

October 1, 1921, to December 31, 1921.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without a license	37	$582 50
Hunting in game refuges	8	50 00
Hunting in posted grounds	5	85 00
Hunting out of season	4	255 00
Trapping without a license	2	20 00
False statement to secure license	2	50 00
Birds: non-game—possession and killing	29	295 00
Deer, male, possession, closed season	10	750 00
Deer meat, possession, closed season	12	150 00
Does, killing and possession	8	500 00
Fawns, killing and possession	3	200 00
Doves, killing and possession	4	50 00
Ducks, overlimit, possession, killing, closed season	10	465 00
Rabbits, possession, killing, closed season	6	125 00
Pigeons, possession	1	----------
Wild pheasants, killing and possession	2	50 00
Spike buck, killing and possession	3	250 00
Yellow hammers, killing and posesssion	12	30 00
Shore birds, shooting and possession	27	200 00
Snipe, killing and possession	5	125 00
Paws of bear, possession	2	20 00
Wild geese, excess limit	2	50 00
Swans, killing	1	25 00
Sea gulls, killing	1	10 00
Killing game in game refuge	3	300 00
Plover, shooting	1	66 00
Excess bag limit	8	275 00
station		
250 feet of fishway		
arf		
mon		
Clams, overlimit, undersized	14	395 00
Placing obstruction in stream	2	50 00
Discharging sawdust in stream	1	50 00
Depositing petroleum in California waters	1	----------
Allowing dogs to run wild and more than one dog per person	3	70 00
Total fish violations	121	$2,820 00
Grand total fish and game violations	424	$9,478 50

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 8 SACRAMENTO, JULY, 1922 Number 3

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MIGRATING SALMON AT THE REDDING DAM.

By E. A. McGregor.

In connection with a lawsuit brought by the Fish and Game Commission against the Anderson-Cottonwood Irrigation District, owing to the alleged stoppage of salmon migration by the Redding Dam (on the Sacramento River near Redding), the writer was delegated to conduct an investigation of the dam from the salmon standpoint. The following observations have been extracted from the writer's report on his findings at the Redding Dam with the thought that they might prove of interest to readers of California Fish and Game.

The period covered by the investigations was from September 14 to October 7, 1921, inclusive. During this time the flash-boards were nearly all in place so that the dam constituted about as much of a barrier as is ordinarily the case. It was ascertained, moreover, that this had been the approximate condition of the dam since the beginning of irrigation in the spring.

The Redding dam (Fig. 61) is constructed fundamentally of concrete, but carries a steel superstructure which in turn supports a system of flash-boards. In detail the dam construction is as follows: A continuous concrete base or apron extends from shore to shore completely across the river—running nearly north and south. The dimensions of this base are: Three feet thick by 26 feet wide by about 440 feet long. Rising above this apron (Fig. 62) are 67 concrete piers with a clearance between them of five feet six inches.

Nature of dam.

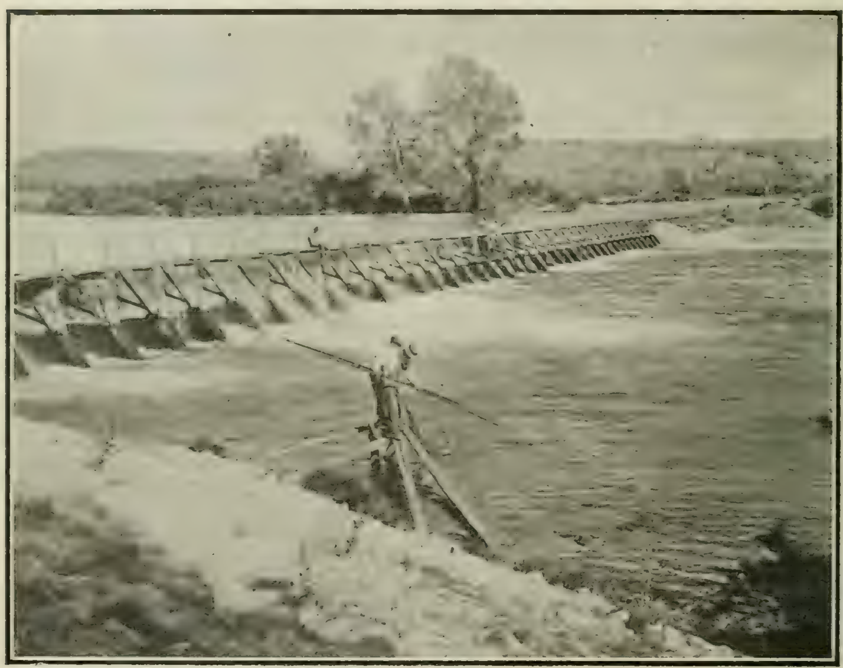

FIG. 61. View of dam from south shore looking northward. Flash-boards practically all in place. This condition exists from spring until about the middle of October.

Each pier is about 12 inches thick, rises slightly over 10 feet above the upper face of the apron, has a basal length of 24 feet and a top length of eight feet, resulting in angled buttresses both upstream and downstream. Each pier contains a deep cavity (see Fig. 63), about four inches wide and six feet deep which receives the folding superframe.

Each pier carries a superstructure of steel. This consists of a braced frame which hinges at the top of the upstream face of the pier. It is so constructed that it can be either elevated to carry additional flash-boards or dropped into the pier cavity so as to be flush with the top of the pier. The vertical height of this superstructure above the

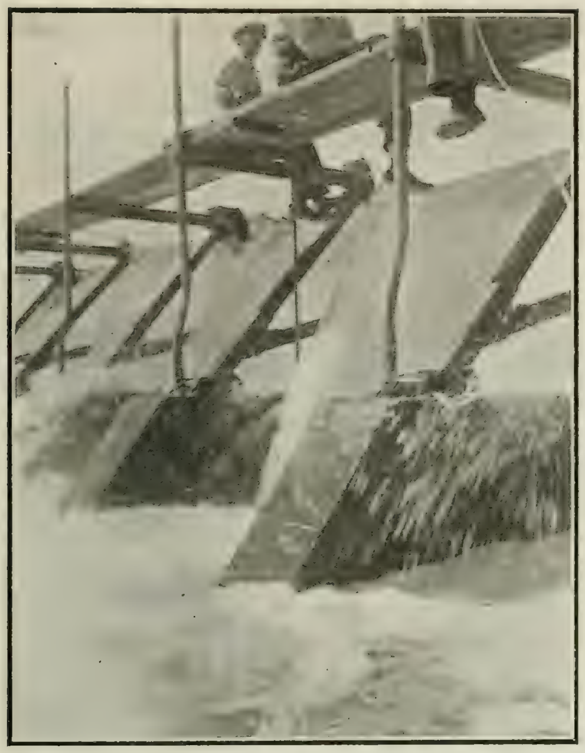

FIG. 62. Piers Nos. 2, 3 and 4 and ports Nos. 1, 2 and 3. Taken near north end of dam looking southwest. Boy spearing in pier pocket for trapped salmon.

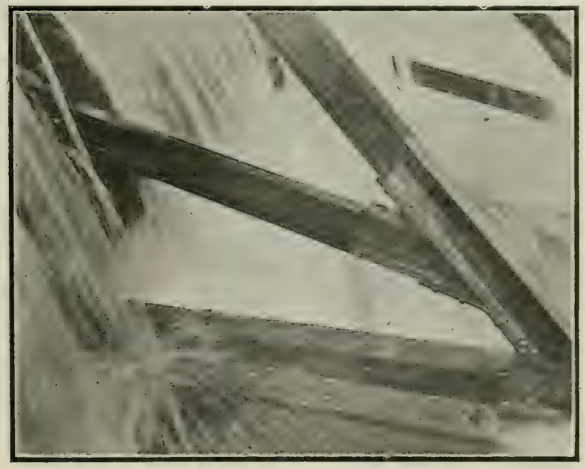

FIG. 63. Compartments 2 and 3, showing top of pier No. 2, with cavity so fatal to salmon.

concrete pier is approximately five feet six inches. Thus, the entire height of the dam crest above the basal apron is about fifteen feet eight inches.

Detailed condition of compartments.

At the time of our first visit to the dam, and continuously thereafter throughout the investigation, the specific arrangement of each of the 68 dam compartments was as follows:[1]

TABLE I.—Condition of Compartments During Investigation.

Compartment number	Boards removed	Inches of water above top board	Compartment number	Boards removed	Inches of water above top board
1	None	2	35	None	3
2	2	24	36	None	0
3	2	24	37	None	0
4	3	30	38	None	3
5	3	30	39	None	2
6	None	2	40	None	3
7	None	1	41	None	4
8	None	½	42	None	5
9	None	6	43	None	3
10	None	3	44	None	2
11	None	0	45	None	1
12	None	0	46	None	0
13	None	0	47	None	0
14	None	0	48	None	0
15	None	0	49	None	0
16	None	0	50	None	0
17	None	3	51	None	1
18	None	0	52	None	2
19	None	0	53	None	4
20	None	0	54	None	0
21	None	0	55	None	0
22	None	1	56	None	5
23	None	2	57	1	8
24	1	12	58	1	10
25	1	8	59	1	10
26	7*	66	60	2	16
27	7*	66	61	2	16
28	None	0	62	None	1
29	None	0	63	None	1
30	None	½	64	None	2
31	None	0	65	None	0
32	None	0	66	None	0
33	None	2	67	None	1
34	None	1	68	Part of 1	10

*Sections 26 and 27 comprise the spillway.

On one occasion a light rain raised the river level at the dam about two inches. With this one exception, the above table indicates the flow over the dam during our investigations. Only nine compartments had a foot or more of water passing over their respective crests. These were compartments numbers 2, 3, 4, 5, 24, 26, 27, 60 and 61. The remaining 59 compartments, for the most part, had only thin films of water passing over them and thus obviously precluded the slightest possibility of the passage of fish therethrough.

Compartments numbers 26 and 27 (see Fig. 64) constitute what the Anderson-Cottonwood irrigation authorities choose to term the "fishway;" in these compartments all the flash-boards were out down to the pier level. Compartments numbers 2, 3, 4 and 5 are at the extreme northern end of the dam. They offer the best leaping possibilities and they will be discussed hereafter at greater length.

---

[1] We have arbitrarily numbered the compartments of the dam, commencing at the northern end, from 1 to 68, inclusive.

Method employed.

The method adopted whereby specific data could be accumulated, capable of demonstrating beyond any doubt the ability or non-ability on the part of salmon to clear the various compartments of the dam in the course of their spawning migrations, was as follows: One compartment at a time was carefully watched for a period of 15 minutes; the total number of leaps and the number gaining the crest of the dam were noted in each period.

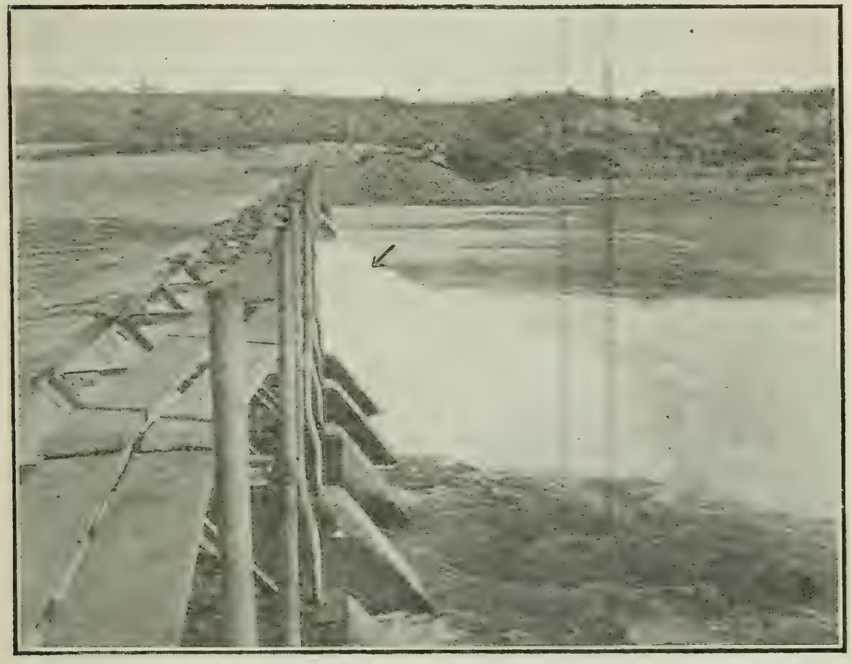

FIG. 64. Spillway from a point 35 feet to the southward. Camera about four feet above level of dam crest.

In all but the spillway—comprising compartments numbers 26 and 27—this method, from the first, proved entirely convincing and trustworthy. However, there were those who maintained that, owing to the depth of water passing through sections 26 and 27, it was possible for salmon to penetrate the down-rushing water without being detected by the eye of the observer. The writer realized that this contention might be employed by the dam authorities and sympathizers to the great embarassment of those trying to establish the case for the fishway.

Visibility through water.

Rather early in the investigation the writer discovered that during a portion of the forenoon—from about 9 a.m. to about 11 a.m.—the sun's rays struck the crest of the dam at such an angle as to sufficiently illuminate the topmost remaining plank at the bottom of the spillway. During this interval, with one's back toward the sun, there were no confusing reflections or refractions from the upstream (western) direction, and the visibility to the bottom under these conditions was all that could be desired.

In other words, when one took advantage of the most favorable conditions, *it was possible to be certain* for every compartment, *whether or not salmon were passing* to the still water above the crest of the dam.

Use of water-glass.

Through conferences with Messrs. Shebley, Scofield, Duke, Doney, Lambson (of the Commission), and Rich and Hancock (of the U. S. Bureau of Fisheries), who visited the Redding dam during our investigations, there crystallized the idea of constructing a water-glass or hydroscope. Such a device was perfected by cementing a plain auto headlight lens into the end of an eight-inch galvanized sheet-iron casing. Tests of this device at the so-called "fishway" were highly satisfactory. Through the employment of the hydroscope—especially in the forenoon—the visibility through the entire depth of the spillway (see Fig. 65) became excellent. *No passing salmon during the use of the water-glass could escape detection.*

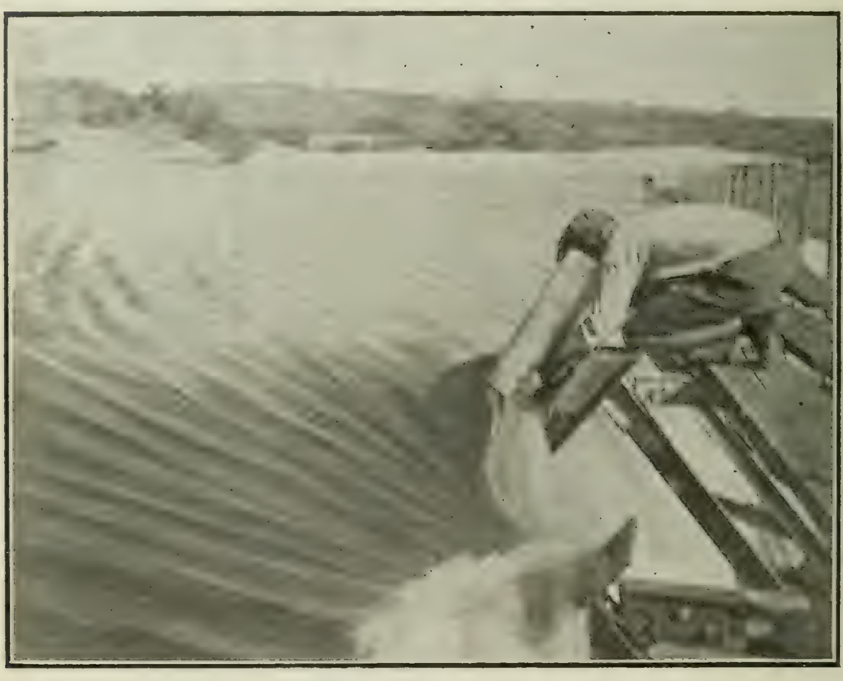

FIG. 65. View at spillway looking northward. Observer peering through six feet of water by means of water-glass.

Detailed data on leaps.

The following table has been prepared from the accumulated data secured in connection with the numerous fifteen-minute counts. It summarizes the information concerning the leaping of salmon at the dam:

TABLE II.—Summary of Observed Salmon Leaps.

Section numbers	Number of 15-minute observations	Total leaps observed	Average leaps per 15-minute observation	Number of fish clearing dam	Estimated leaps in 12 daylight hours
1	3	8	2.66	0	127.68
2	59	1,644	27.86	9	1,337.28
(2 and 3)*	(2)	(65)	(32.50)	0	
3	36	195	5.42	1	260.16
4	3	1	.33	0	16.00
(4 and 5)*	(2)	(6)	(3.00)	0	
5	7	13	1.86	0	89.28
24	1	4	4.00	0	192.00
25	2	3	1.50	0	72.00
(25 and 26)*	(1)	(4)	(4.00)	0	
26	9	27	3.00	0	144.00
(26 and 27)*	(13)	(90)	(6.92)	0	
27	12	54	4.50	0	216.00
(27 and 28)*	(1)	(8)	(8.00)	0	
30	1	0	0	0	0
40	1	0	0	0	0
41	1	0	0	0	0
47	1	0	0	0	0
60	3	0	0	0	0
61	2	0	0	0	0
67	2	0	0	0	0
68	3	10	3.33	0	160.00
Totals	165	2,132		10	

Leaps per twelve-hour day, 2,614.40. Per cent clearing dam, .469.

*On a few occasions the observer watched two compartments at a time.

From the foregoing table it will be seen that in the course of 165 fifteen-minute observations 2132 leaps were observed. Out of this number only 10 fish managed to gain the crest of the dam. This yields a percentage of .469 (less than half of one per cent, of successful leaps. Based on our data, it is computed that approximately 2614 salmon leaps occurred each twelve-hour day during the course of our observations.[1] In other words, our data reveals that in the course of a twelve-hour day (daybreak to dusk) an average of 2614 salmon attempted to leap the dam; of these 12 (.47%) succeeded, while 2602 (99.53%) failed.

Night leaping doubtful.

From actual nocturnal observations, and from the declarations of fishermen, it seems established that very little, if any, leaping occurs at night. In an hour's close watch on a very bright moonlight night, not an attempted leap was seen. Furthermore, it is said that trapped fish are rarely taken from the pier pockets immediately after daybreak, which fact confirms the above contention. This, if true, would confine our considerations to the diurnal activities of salmon.[2]

---

[1] This figure represents a conservative estimate since we have assumed that 58 compartments are entirely unattractive for leaping.

[2] The nonoccurrence of salmon leaping at night has been corroborated by the declarations of the workers at the racks.

So far as our observations have progressed, we believe we may state that it is strongly indicated that all salmon individuals that were seen to gain the crest of the dam were small males, commonly called "grilse." They are spry and muscular (mostly between two and six pounds) and are unencumbered with surplus weight. The apparent failure of females to pass the dam is a point which deserves serious consideration in connection with normal upstream spawning activities. Furthermore, one can not help but note that the females, after "fighting" the dam, fall comparatively easy prey to the expert spearing fishermen.

Females barred.

By the very nature of the dam, constituting as it does an almost unsurmountable barrier, there is a resulting piling up or concentrating of salmon in the river immediately below the dam. This naturally facilitates fishing operations at this point on the river. The common methods of capture observed during the investigation were, namely, spearing, use of grabhook, set line, rod and reel and dip nets.

Dam barrier aids capture.

From the evidence adduced, the spearers (see Fig. 61) land about one out of five salmon hit. It is claimed—and it seems probable—that those injured and escaping have slight chance of recovery in the fungus-laden fresh water. The grabhooks are, like the spears, operated directly from the dam. In addition, they are used to extract the salmon which frequently fall into the cavities in the concrete piers. Spearers and others frequently employ setlines as a supplement to their other activities. Certain parties were observed using dip nets to trap the salmon as they fell back after attempted leaps. Tourists and sportsmen operated daily with rod and reel. Fishermen of all types have come to know that salmon concentrate below the dam during the period that the flash-boards are in place.

To the casual observer, the cruel battering against the dam is a more obvious realization than is the failure to gain the crest. As will be discussed later, the majority of the salmon fail to leap to the best possible advantage. Owing to the impact of the excessive drop of the water, much foam at the base obstructs the vision. As a result, the path of the leap is usually at an angle to the perpendicular to the crest (*i. e.*, to right or left of a direct upstream line). This results in innumerable cases of individuals crashing against the cement piers and the steel superstructure. We have seen salmon float helplessly following these collisions. Stunned fish occasionally strand on the pebble bar below the northern end of the dam.

Injuries sustained.

A more spectacular type of accident occurs when leaping fish fall into the cavities in the piers (see Fig. 63). In some of these the water escapes through holes below, too small, however, to permit the escape of the trapped salmon. All salmon falling into these pockets are doomed. Every day dozens of fish are extracted from these holes—many of them badly battered from their desperate endeavors in attempting to escape.

Pier holes are traps.

It is impossible to estimate the percentage of salmon which are destroyed through contact with the dam structures. It must be very heavy, however, and many observers believe that the majority of the migrating salmon continue to "fight" the dam until they perish.

Fungous disease.

A type of fungous disease is quite prevalent among salmon in the river, and it is probable that this disease is enabled, in part, to infect the fish through the abrasions caused by battering against the dam. We have seen badly infested salmon drifting weakly downstream above the dam, which fact indicates the influence the dam may exert on a certain number of individuals even after they have luckily leaped it.

Concerning the spillway.

The authorities in charge of the dam have selected compartments numbers 26 and 27 for the location of the spillway (see Fig. 64). With no little humor, they speak of it as the "fishway." From side to side this gap in the dam[1] measures 12 feet. The flash-boards are removed down to the level of the top of the concrete piers, so that nearly six feet of water passes over the topmost remaining plank. It is necessary to behold this spillway to gain a clear comprehension of its nature. Through the gap tumbles a crashing deluge. (This is true even at the low stage of the river.) Upon reaching the level of the river below, the torrent churns and boils in a fierce madness that resents resistance. Within a large fan-shaped zone adjacent to the base of the spillway there is a continual seething chaos.

Wary of spillway.

We have observed, and without surprise, that salmon do not often venture into this maelstrom. The great majority seem instinctively to avoid it. When rarely, an individual "stumbles" into the "boil," it is tossed about in a nearly helpless condition. The few leaps that are attempted therefrom are always abortive. The direction of these occasional leaps is about as likely to be away from the dam as toward it. The salmon appear instinctively to realize that they possess slight chance of leaping effectively from this spot.

During the many hours spent on the dam, the total recorded number of well-directed leaps at compartments numbers 26 and 27 (the spillway) have been few indeed. Most such attempts carried the individuals but two or three feet above the stream level and, upon contact with the spillway falls, were dashed hopelessly back again into the seething "boil" from which they rose.

Conditions bad below spillway.

We are reliably informed that the spillway was located where it is because of the fact that a large mass of stone occurs on the river bed immediately below this point. Whether this was placed there, or whether it is a natural dike is not established. This aggravates the turmoil below the spillway, causing an unfavorable shallowness there, and helps to defeat the intended purpose of the miscalled "fishway." It prevents erosion and back cutting which obviously explains why the dam officials chose this location for the spillway.

Water-glass at spillway.

By means of direct double observations, it was possible to establish positively that salmon can not and do not gain the crest of the dam at the spillway. These observations were conducted as follows. Our assistant watched carefully for attempted leaps at the base of the spillway falls for a certain period (usually 15 minutes). During this same interval the writer, by the use of the water-glass, gazed through the six feet of water to the topmost remaining flash-board beneath the spillway. So perfect was the visibility when the hydroscope was employed that the passage of the smallest migrating fish could not escape detection.

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[1] Obviously this gap in the dam functions as a spillway only when the flash-boards in the remaining compartments are in place.

An observation which contributes to prove that the spillway region is unfrequented by salmon, is the fact that the seasoned old spearers and other fishermen never operate at that portion of the dam (which they naturally would if the spillway functioned as an avenue of migration, as claimed by the dam authorities).

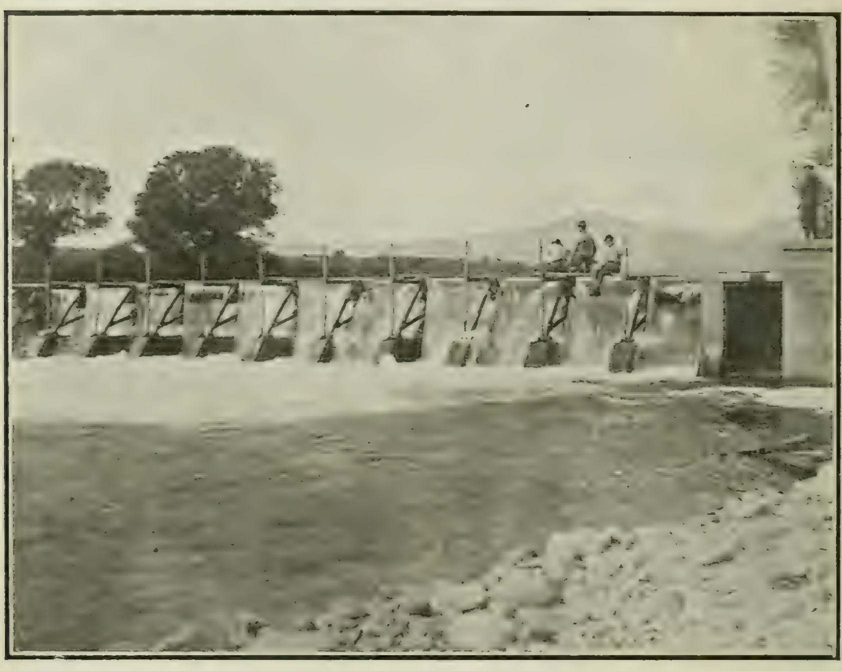

FIG. 66. North end of dam from down stream; camera directed up stream. Figures grouped above compartment No. 2, at which point most leaping occurs.

Most leaping at section number 2.

As has been previously recorded, compartment number 2 (at northern end of dam—(see Fig. 66) is conspicuously the point on the dam most preferred by the salmon for attempted leaps. As revealed in a following table, out of a total of 2132 observed leaps. 1644 of them took place at section number 2. This represents 77.1 per cent of all leaps recorded during the investigation. Clearly, there must be an explanation for this striking phenomenon.

One of the laws of hydraulics of a stream is, namely, that the flow is strongest at the center and weakest at the margins of the stream. Also, as the depth increases the current decreases, and vice versa. Now, compartment number 2, obviously, is at the margin of the river, and is immediately above the largest and deepest pool adjacent to the dam. It follows, then, from the above-quoted law, that the quietest water along the dam is to be found at this particular point. Moreover, the flash-boards of number 2 were so arranged that a vertical depth of 24 inches of water was spilling thereover. As will be developed later, it is true that newly arriving salmon "prospect" along the base of the dam in an endeavor to locate the most propitious point for leaping. By elimination they ultimately select compartment number 2 as the point at which to center their efforts.

Too much emphasis can not be placed on our contentions that the above spot (compartment number 2 and vicinity) is the natural and most logical location for the construction of the proposed fishway (provided the topography of the river bed continues fundamentally as when our observations were made).

Salmon leaps analyzed.

a. *Reconnoiter.* From our rather intimate studies of leaping salmon, we are convinced that the great majority of individuals examine the "falls" prior to attempting the leap. They are seen to swim directly into the base of the falling water and, returning, pass through it again. The theory suggests itself to us that some instinct or special sense enables the salmon to gauge the height and amount of water passing over the crest, by means of the impact experienced in these passages through the falls.[1] At the same time the individual ascertains, for the moment, the relative location of the obstacle to be cleared.

b. *Initial leap.* When a salmon is thus observed cutting and recutting the base of the falls, it may be assumed with considerable certainty that the attempted leap is imminently at hand. After sufficient lapse of time to permit the individual to dive down to a chosen starting point, and to shoot upward to the surface, the recent "prospector" almost invariably essays its first leap (this applies only to compartments where conditions are at least remotely favorable.) Owing to the artificial nature of the Redding dam (and to its non-existence in the phylogeny of the Sacramento race), the necessary effort is always under gauged in the case of the initial leap. The result is, at best, a four- or five-foot jump.

c. *Subsequent efforts.* The delay or non-delay of the later leaps depends on the success of the initial attempt. Individuals that strike the falls in a well directed manner immediately "gather themselves together" and repeat the leap with very little delay—often within 10 or 15 seconds. In cases, however, (and they are very frequent) where the first leap results in contact with the cement piers, steel superstructure, or the downstream face of the flash-boards, the individual's "spirit" seems to be "broken," for the time, and these fish are not observed to leap again soon. It should be added that an individual usually advances with each succeeding leap until either it gains the crest (rare indeed) or wears itself out.

d. *Point of starting leap.* Owing to the structure of the dam, with the downstream projecting piers, the salmon are greatly handicapped in their leaping. As they dart upward through the water, in the momentum gaining portion of the leap, the submerged buttresses of the piers constitute, no doubt, a vital factor in determining the point of emergence from the water. Probably the majority of the leaps start from points below (*i. e.* downstream) the eastern margin of the buttresses. This necessitates an aerial leap of about eight and one-half feet in height and approximately eight feet in horizontal distance in order to gain the crest of the dam. As a matter of fact, the vast majority of leaps thus started become abortive since the trajectory of the fish meets the falling sheet of water at a right or descending angle.

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[1] This may be one of the functions of the lateral line organs.

e. *Direction of leap.* As has been previously recorded, the majority of the leaps are misdirected. The irregular outline of the dam—consisting of alternating buttresses and ports—is the factor most to blame, we believe, for this inaccuracy in leaping. This condition in no sense simulates the contour of a natural waterfall, and the salmon's instincts are unavailing as against the artificial barrier. The abundant presence of foam and "white water" work to aggravate this malcondition by obscuring the real location of the crest of the dam, which might otherwise be gauged through the fish's optic sense. Probably other senses, such as "direction of flow," "source of impact," and sound, are the chief guiding agencies.

Under a previous heading we have described the common occurrence of salmon diving headfirst into the piers and superstructure as a result of misdirected leaps.

f. *Height attained.* The great majority of the jumps are surprisingly futile. We would roughly estimate that the average height of all observed leaps is not in excess of three feet. Some individuals elevate themselves less than a foot above the water level. On the other hand, some remarkable leaps have been witnessed. Two small salmon (probably "grilse") were seen to strike against the plank footway which is about two inches higher than the crest of the dam. Another individual, whose leap was successful, actually leaped a trifle beyond the crest and struck the smooth water a few inches upstream. Such leaps as the two last mentioned, however, are so rare as to be hardly deserving of consideration.

g. *Successful leaps analyzed.* There seem to be two types of successful leaps. In one case the salmon leaps high and squarely toward the crest. The instant the fish cuts the water (immediately below the crest) it forges straight ahead through the utmost application of its swimming power. Usually in such cases the salmon is almost at a "standstill" at the moment of passing the crest.

In the other type of successful leap, the fish may not soar quite so high, but cuts into the falls at an angle toward the side of the compartment. It appears to flex or arch the body in such a way that the flow of the "falls" has a tendency to force the individual sidewise and upward—like a boat "quartering" against a current. Probably the initial momentum operates to assist in the ascent through the falling water.

In either case, upon gaining the crest, the fortunate individual dives quickly downward toward the zone of least flow.

Miscellaneous observations.

a. *Arrival of a fresh school.* The arrival of a new school at the dam is quickly detectable. The individuals are much more active and they all seem to be "possessed" to leap at the same time, so that there is a condition at the dam approaching congestion. At such times, before the school has become badly dispersed through "fighting" the dam, it is a common sight to see the salmon leaping simultaneously in pairs. Just what they may gain by this phenomenon is difficult to see. The leaping pairs are frequently of the same sex.

b. *Fishermen's testimony.* Several fishermen, of whom we solicited opinions relative to the passage of salmon over the Redding dam, were in complete accord with Jean Barion—a pioneer fisherman of this region. In reply he asked: "Why would we journey miles down the river from our homes to fish at the dam if we could get fish up where we belong?" Jean's sentiment is a dramatic refutation of those who dare to claim that the dam is no serious barrier to the upstream movement of salmon.

The writer has repeatedly asked upstream residents what they knew concerning the prevalence of salmon above the dam—especially during the months when the flash-boards are in place. All have been agreed that they have become extermely scarce since the erection of the dam. Several keen observers informed me that they had seen no sign of mature salmon during the summer months.

c. *Net experiments.* With the idea of attempting to establish beyond doubt the precise number of salmon clearing a particular portion of the dam in a given time, the use of a net suggested itself. Accordingly, Mr. Wm. Shebley, Superintendent of Hatcheries, upon request, dispatched to the scene about 30 feet of small mesh seine. This was placed, by various means, just above the crest of the dam. Unfortunately the force of the current was such that the lead line was invariably swept down over the dam with the result that the normal activities of the fish were interfered with. In the course of these trials the net was rather badly torn and we were forced to abandon this phase of the investigation.

It appears that the only practical way of applying this idea would be to stretch a seine entirely across the river at a safe distance above the falls. Mr. Shebley stated that he had once figured on constructing a rack across the stream from shore to shore above the dam, but that lack of available funds had prevented the test.

We hasten to state, however, that measures so heroic as these are not needed to convince scientific observers that only a negligible percentage of the salmon run is able to pass the Redding dam. A test of the above sort would no doubt be convincing to open-minded persons, but probably not to the type of men who oppose fishways in general.

d. *Oxygen stimulation and leaping.* While we are recording observations independently arrived at, it may not be amiss to include the following theory. As we know, fishes breathe by means of the presence of free oxygen in the water. Immediately below a dam or falls there obviously is a superabundance of air—and consequently free oxygen—carried in the "white water." In the wonderful balance of Nature it may be that fish derive their marvelous leaping energy from the temporary stimulation exerted by means of this excess of oxygen *to be found in the very portions of the streams* where piscean energy is vitally needed.[1]

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[1] In reading my manuscript, two authorities have criticized the above theory. They contend that physiologists have demonstrated that the red corpuscles of the blood are definitely limited in the amount of oxygen which can be taken up, and that this fact invalidates my theory. I am not ready to admit that my critics are correct. As a first counter argument I propose the possibility that in the more sluggish portions of rivers salmon may not secure the maximum supply of oxygen that is desirable from the standpoint of maximum energy, whereas, on the other hand, this optimum condition *is* found at points where the stream is greatly agitated. In other words, is it not possible that mature migrating salmon may secure such supplies of oxygen immediately below falls as to suffice for the utmost demand on their energy, whereas this condition is not elsewhere encountered? My other postulate is, namely, that the imminent need of leaping power, with the resulting physical exertions that obtain at a stream barrier, call into being the formation of a higher corpuscle content in the blood. Obviously this would have the effect of imparting to the blood an increased oxygen-carrying coefficient. Surely, the burden of proof falls on those who make the claim that piscean activity does not respond to a changing supply of available free oxygen.

In a recent paper by Gilbert and O'Malley[1] relative to salmon of the Yukon River they present a table designated to indicate the rate of travel of the spawning run up the Yukon River. Based on their data the first 279 miles up from the mouth was made at an average rate of 34.9 miles per day; the next 276 miles at 46 miles per day; the next 296 miles at 74 miles per day; the next 376 miles at 47 miles per day; and the remaining intervening 277 miles to Dawson at the average rate of 92.3 miles per day. With the exception of the 376-mile stretch, there was a very obvious increase in the rate of travel over the 1504 miles as the salmon progresses toward the headwaters of the Yukon. The final 277 miles (below Dawson) being covered at the fastest rate of the several legs of the journey. This phenomenon further substantiates the above presented theory of the influence of oxygenation upon the fluvial activities of mature salmon, since the Yukon no doubt, like other streams, is more broken and interrupted in the upper reaches.[2]

We will refrain from using a formal summary and merely recapitulate to the extent of stating that a careful investigation of the Redding dam—covering a period of over three weeks—has positively established the fact that said dam (as it was during our observations) constitutes an almost perfect barrier against the upstream migration of salmon to their natural spawning beds. Careful computation indicates that, during the period from September 14 to October 7, 1921, inclusive, 99.53 per cent of the salmon which arrive at the foot of the dam are unable to pass it, and are thus denied the possibility of propagating their kind.

Whether it is possible that a portion of this barred horde may persist below the dam until the flashboards are removed at the close of the irrigation season, is not established. However, between fishermen, mechanical injury at the dam, precocious spawning, infectious diseases and other inimical agencies, the mortality is shockingly severe.

The officials of the Anderson-Cottonwood Irrigation District probably took the position that the matter of serving their patrons with irrigation water is of more vital concern than is the migration of salmon which supplies the upper Sacramento system. Fortunately, in the case of a river obstruction of the height of the Redding dam, the construction of a practicable fishway is not a difficult matter. The Fish and Game Commission has prepared plans for such a fishway and the commission intends to see that adequate provisions are installed at an early date in order that the salmon run may become reestablished as it has been since time immemorial.

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[1] Investigation of the Salmon Fisheries of the Yukon River, U. S. Bureau of Fisheries, Document No. 909a.

[2] In the published works of Wells, Shelford, Allee and others on the reaction of fishes to various concentrations of oxygen and carbon dioxide, it develops that the oxygen content varies from 1 to 15 c.c. per liter and the carbon dioxide from —7 c.c. to 47.8 c.c. per liter under diverse natural conditions. Wells states that "the lower end of a 50-foot pool in a small creek may contain 5 c.c. per liter of oxygen less than the water of the upper end." These workers also have shown that fishes often react in behavior to an oxygen concentration as high as between .7 and 1 c.c. per liter, and are even more susceptible to carbon dioxide. They show that oxygen in large amounts (10 c.c. per liter) combats the detrimental effect of high carbon dioxide (50 c.c. per liter).

RECORDS OF THE CAPTURE OF FUR SEALS ON LAND IN CALIFORNIA.

By Edwin C. Starks.

Of the many accounts of the taking of fur seals on land in California—especially on the outlying islands, none of them tells whether the seals were the Alaska fur seal, *Callorhinus alascanus*, or the Guadalupe Island fur seal, *Arctocephalus townsendi*. The reason for such neglect is that when most of the records were made it was not known that the Guadalupe fur seal was quite different from the Alaska fur seal.

Dr. C. Hart Merriam described the Guadalupe fur seal in 1897 from some weather-worn skulls picked up on the beach at Guadalupe Island by Dr. C. H. Townsend. Pictures of the type skull are here reproduced. Dr. Merriam wrote: "The species seems doomed to speedy extermination, and, so far as known, no museum in the world has a single specimen." Only 15 or 20 years before that time there were thousands of fur seals on Guadalupe Island, but within a space of a very few years sealers had almost completely exterminated them. One or two expeditions have since attempted to obtain specimens, and though a very few have been seen none has been secured. This island appears to have been the scene of the last stand of this species of fur seal, which was probably the species that was at one time abundant on the outlying islands of our coast.

The Alaska fur seal migrates every year from its breeding ground on the Pribilof Islands in Bering Sea southward to some point off the California coast. This point is variously stated from "off the coast of northern California" to "the latitude of southern California." With the exception given below of the Alaska fur seal, that was found on the Oregon coast, there is no evidence that they ever come to land.

Now all of the animals of this group have habits that are as nearly unchanging as habits conceivably can be, and we can feel reasonably sure that if the Alaska fur seals ever had the habit of landing during their migration they would still do so. On the other hand, the fact that the Guadalupe fur seal is practically extinct is an irrefutable reason to explain the present absence of that animal on our coast, where once it may have been abundant. What fur seal was found on the Farallones, is perhaps more problematical than what seal was found on the Santa Barbara Islands, which are more nearly in the same faunal zone as Guadalupe Island.

Dr. C. H. Townsend (Rept. Fur Seal Invest. 1896–7. Vol. III, p. 268) says: "From the history of the smaller seal rookeries of the Pacific Ocean, it would seem that the fur seal could not be driven away to new islands, but stupidly lingers about its ancient haunts until extermination overtakes it." Though the Farallones may not have been a rookery (breeding place), they still were an "ancient haunt" of some form of fur seal. If the above trait can be relied upon it seems to indicate that the seal that inhabited them was the exterminated species, in other words, the Guadalupe fur seal.

On the other hand, perhaps the only record that we have of the landing on our coast of a fur seal of which the species is definitely known, is of an immature male Alaska fur seal that came ashore on the Oregon coast, as recently recorded by the Journal of Mammalogy (Nov., 1921). It, of course, may have been sick.

As recorded by Bancroft* (XIX Hist. Calif. II 1801 to 1824) William Gale, captain's clerk of the ship Albatross, in a voyage along the California coast in 1809 to 1812, gives many items in his journal as to sea otter and seal fishing. In July, 1810, Gale was left on the Farallone Islands with seven men. Here he found two other bands of men that had been left a short time before from other ships, apparently of the same ownership and interests as the Albatross. By December, when the Farallone party was communicated with, they had taken 30,000 seal skins. In three years they took as follows:

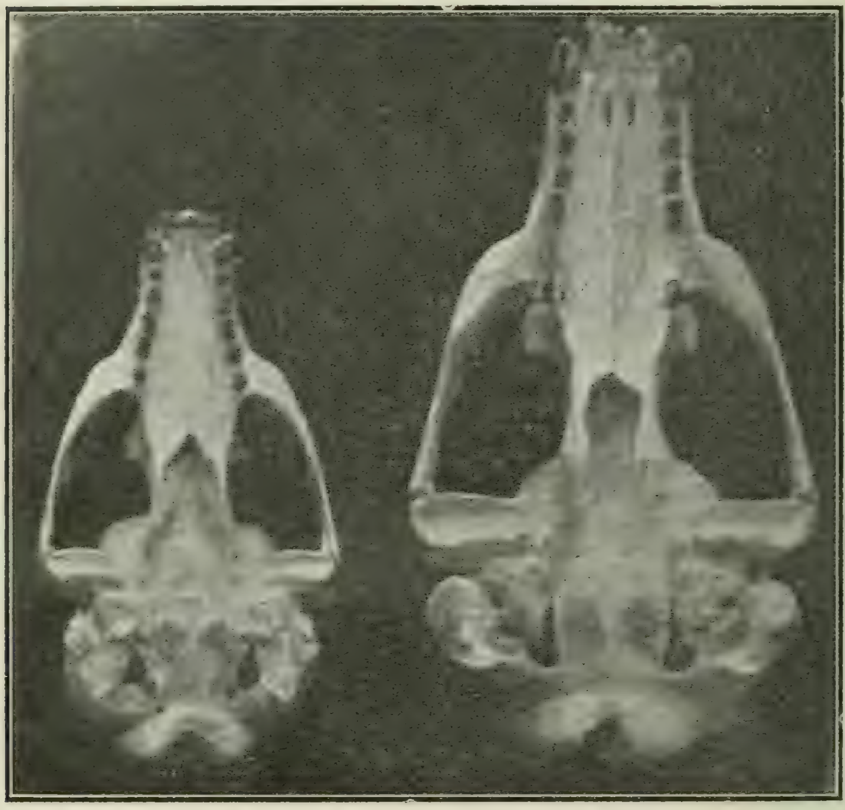

FIG. 67. Skulls of California (smaller) and Steller's sea lions. Note the wide space between the last molar tooth and the next one in Steller's sea lion. Both species have much longer muzzles than the fur seals.

1810, 33,740 skins; 1811, 21,153 skins; 1812, 18,509 skins; total for Farallones, 73,402 skins.

There is nothing in the report to indicate that these seals were not taken at sea, in which case they might have been of the Alaska migrating herd. But the time of the year at which they were taken would prove conclusively that they could not have been Alaska fur seals. It will be noted that Gale landed on the Farallones in July

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*In a footnote Bancroft quotes that Capt. B. Smith with a party took 130,000 fur seals on the Farallones in two years, beginning 1808.

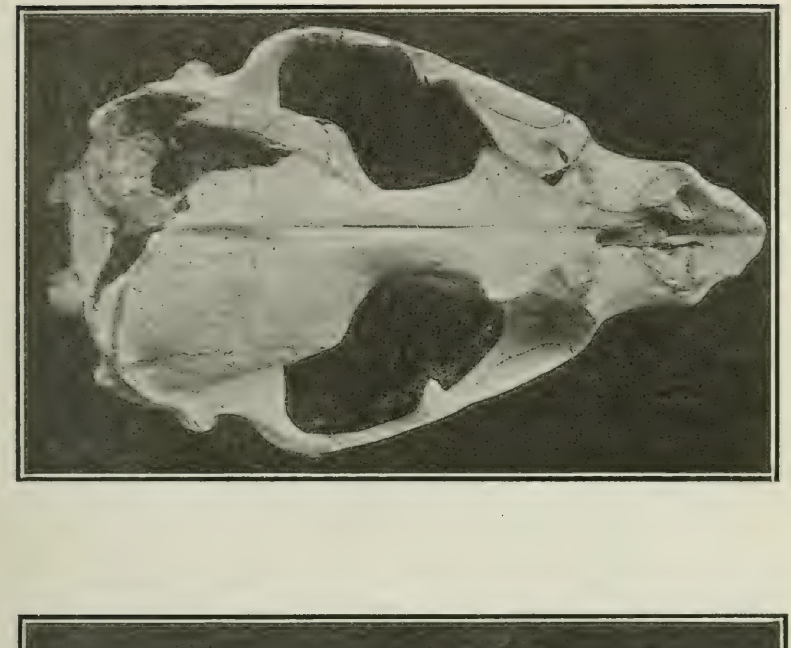

FIG. 68. Dorsal and ventral views of skull of Guadalupe fur seal. Photograph of type specimen in U. S. National Museum. (No. 83617.) Note the long narrow space between the rows of teeth and the short muzzle, as compared with the sea lions.

and by December had taken 30,000 skins. The Alaska fur seals appear off the coast about the middle of December. December 10 is the earliest date that one has been taken. Sealing at sea in California is continued through April, by which time the seals have got farther north. Gale took for the year 33,740 skins, so less than 4000 were taken after December, which would have been the only possible time the Alaska fur seal could have been obtained.

Bancroft further records (same volume, p. 633): "From 1812 to 1840 the Russians kept up an establishment at the Farallones as well as at Ross. The object at first was to secure fur seals, 1200 to 1500 skins being taken annually for five or six years, though Winship, Gale, Smith, and other Americans had taken the cream of this natural wealth a few years earlier. After 1818 the seals diminished rapidly until only 200 or 300 per year could be caught."

Sealing seems to have been resumed profitably in 1824. In G. Brown Goode's "Fisheries and Fishery Industries of the United States" (Sec. V, Vol. II, p. 357 footnote) is given a table of the number of fur seals taken on the Farallones for the years from 1824 to 1833. In the first year over a thousand were taken, but the number was less than 500 for the next year, and decreases gradually to 54 at the last year. The steady decrease of this and of the Gale operations is significant, for it would scarcely occur during this length of time if the record were of seals taken off the island in the open sea. In other words, shore sealing would probably indicate a local herd, while pelagic sealing would more probably have to do with the great migrating herd of Alaska fur seals from the north that could not be so easily or quickly depleted. The rapid recovery between each series of years of consecutive sealing could be explained, theoretically at least, to natural breeding. Without considering the natural forces of destruction, 100 females could increase in five years to 1600. Just what the natural loss would be if they were left undisturbed is problematical, of course. These figures are given only to show that the rapid increase is not too great to be explained by breeding only, though it was probably due to other causes as well, such as a migration from island to island.

In the same footnote is the statement that in 1878 a few hundred fur seals were taken by sea lion hunters on Santa Barbara and Guadalupe islands. The former locality is the only one of interest, for there is no doubt as to the seals of the other locality.

From "Life in California," by A. Robinson, published in 1846, but written from notes made from 1828 to about 1842, I copy this: "Finally we saw the rocks called the Farallones. We soon passed the largest and southermost one, which was still occupied by the Russians; and could distinctly perceive among the huts ten or twelve persons, who were living there for the purpose of catching fur seal, which were so abundant in former years, that my friend G——— assured me he had assisted in collecting during one season over 80,000 skins from this same island." Farther on in the book "friend G———" pointed out the place on the island where fur seals were clubbed. This was in 1833, and "many years had passed." The extravagant number stated, which far exceeds other records for the Farallones of this date more or less invalidates this account. I quote it because it is the only one that indicates how and where the seals were taken, or that they were taken on land and not at sea.

From "Natural Wealth of California," by T. F. Cronise, published in 1868, I copy the following: "There is a species of fur seal (yet undetermined scientifically) which visits the Farallones, and other islands of our coast, in small numbers." The author recognizes the sea lion for he states that it is of little value.

Captain C. M. Scammon, in "Marine Mammals of the Northwestern Coast of North America," in 1874, writes: "On the coast of California, many beaches were found fronting gullies, where (fur) seals in large numbers formerly gathered; and as they there had plenty of ground to retreat upon, the sealers sometimes drove them far enough back to make sure of the whole herd, or that portion of them the skins of which were desirable."

Mr. Frank Stevens in his book on "California Mammals," says: "When California was first settled by the whites, fur seals were occasionally found on some of the islands, and at a few localities on the mainland, but whether these were of this (Alaska fur seal) or of the following species (Guadalupe fur seal) is not now known."

Dr. C. H. Townsend, in "Report of Fur Seal Investigations" (1896–1897, Vol. III, p. 268) in referring to Guadalupe fur seal says: "It is reported that five seals were taken on Richardson's Rock, off San Miguel Island, one of the Santa Barbara group, in 1890."

In 1902, when I was studying sea lions of Santa Cruz Island, I was told by Capt. Roselyn Vasquez, a man who had considerable experience as a sealer in Alaska, and in capturing sea lions for zoological gardens, that the year before three fur seals had been killed on the island. This was later repeated to me by a man in Santa Barbara, where, if I remember correctly, the skins were sold.

Dr. Gray received at the British Museum from Monterey in 1859 the skin of a fur seal. Dr. Allen (North American Pinnipeds) naturally referred this to the Alaska fur seal, the Guadalupe seal not having been described at that time. Which of these two forms it is remains unknown, and probably will remain unknown until the differences between them in pelage are better known. The skull that accompanied the skin did not belong to it.

Recently I was told by Mr. Michael Noon of Monterey, who had spent years of his early life at various of the California shore whaling stations, that once he had seen a considerable band of fur seals that had landed in a little bight at Monterey near the old custom house.

Just as I have finished this paper I receive from Mr. A. W. Anthony, Director of the Museum of the San Diego Society of Natural History, a letter dated April 15, 1922, telling me of the latest capture of a Guadalupe fur seal on our shores. It is a two-year-old female, captured alive, and has been placed in the San Diego Zoological Garden where it is doing well.

On the whole, the weight of evidence seems to point to the conclusion that of the seals that have been taken on our coast, when taken on land were the Guadalupe fur seal (*Arctocephalus townsendi*).

1. The present absence of the fur seals on the islands is accounted for if they were of the Guadalupe species, which is not the case if they were of the Alaska species.

2. The time of the year that some of the seals were taken on or about the Farallones proves that they, at least, could not have been Alaska fur seals.

3. The evidence of the rapid falling off of the catch in each of the records we have of sealing during consecutive years makes it probable that it was not the great Alaska fur seal herd that was drawn from.

It is hoped that steps may be taken looking towards the absolute protection of this seal, if any still exist on Guadalupe Island, which is probable, together with the small remaining band of elephant seals of the same locality.

The pictures here published of the skull of *Arctocephalus townsendi* (type) were kindly furnished by the United States Biological Survey through the interest of Dr. C. Hart Merriam. It is hoped that anyone finding such a skull on any of the outlying islands will send it to the California Fish and Game Commission at San Francisco. A skull from the Farallones would be particularly valuable. In this way we could learn whether the skull was of the Alaska or of the Guadalupe fur seal; obviously very desirable information. There is danger of mistaking the California sea lion for the fur seal. To show the differences photographs of the skulls of the sea lions are here published. Note that they have much longer muzzles and that the rows of teeth are not nearly so close together.

OBSERVATIONS ON THE EGG YIELD OF KLAMATH RIVER KING SALMON.

By E. A. McGregor.

In 1921 Professor J. O. Snyder published a short note in California Fish and Game entitled "How Many Eggs Does a Salmon Lay?" His conclusions were based on a series of 30 king salmon from the Klamath River. He found that the number of eggs per female varied from 2146 to 4842—a range of 2696, with an average of 3572. Professor Snyder called attention to the fact that the size and egg-content of the right and left ovary usually differ somewhat, and that in his series the left ovary was more often the larger. He further concluded that no very definite relation was to be seen between size, weight, or age and the number of eggs.

The present writer, at the suggestion of Professor Snyder, has recently conducted a similar examination of the ovaries of 68 king salmon from the Klamath River. The method of computing the number of ova was the same as that used by Snyder. It consisted of carefully weighing the ovaries, counting the number of ova per 10 grams, and then calculating the total number. The method was found to be accurate within about one per cent.

It is of interest to note that the author's series presents a somewhat different composition from that of Snyder's. Our ova counts (see Table I) varied from 2013 to 8406, or a range of 6393 and averaged

TABLE I.—Analysis of 68 King Salmon Females With Reference to Length, Age and Ovary Characteristics.

Fish number	Date, 1921	Weight, left ovary, grams	Weight, right ovary, grams	Eggs in left ovary	Eggs in right ovary	Total eggs	Length of fish, cm.	Age of fish
1	8-15	110.4	120.4	966	1,047	2,013	92	5
2	8-27	50.5	49.7	1,164	1,307	2,471	65	3
3	8-12	35.3	29.4	1,331	1,170	2,501	61	3
4	9-2	77.8	75 5	1,291	1,310	2,601	66	4
5	8-15	40.2	41.1	1,333	1,299	2,632	68	4
6	8-16	181.5	181.5	1,316	1,379	2,695	85	6
7	8-31	66.8	62.9	1,386	1,352	2,738	73	4
8	8-24	110.6	115.1	1,355	1,468	2,823	70	4
9	8-16	57.2	54.4	1,499	1,474	2,973	68	3
10*	------------	96.2	98.0	1,477	1,558	3,035	----------	----------
11	8-22	89.1	86.0	1,550	1,496	3,046	71	4
12	9-6	144.5	144.2	1,546	1,500	3,046	81	5
13	8-24	120.2	107.5	1,581	1,489	3,070	76	4
14	8-20	90.5	99.4	1,425	1,650	3,075	77	4
15	8-24	191.6	203.4	1,494	1,607	3,101	80	4
16	9-1	60.6	58.0	1,576	1,563	3,139	70	4
17	8-31	179.1	171.8	1,594	1,581	3,175	84	5
18	8-19	104.0	94.9	1,591	1,590	3,181	69	4
19	8-12	237.0	220.0	1,647	1,609	3,256	88	5
20	9-2	146.0	147.2	1,599	1,678	3,277	100	6
21	8-27	114.1	123.2	1,573	1,725	3,298	74	4
22	8-19	205.9	211.0	1,647	1,656	3,303	86	4
23	8-18	36.3	32.7	1,670	1,635	3,305	66	4
24	8-4	89.0	86.2	1,718	1,629	3,347	77	5
25	8-26	70.1	70.5	1,675	1,685	3,360	71	4
26	8-16	83.5	85.5	1,620	1,753	3,373	73	4
27	9-5	134.8	124.0	1,739	1,674	3,413	71	4
28	9-3	158.6	162.7	1,697	1,749	3,446	88	5
29	8-31	175.6	223.6	1,730	1,756	3,486	91	5
30	8-25	200.9	197.2	1,768	1,755	3,523	82	4
31	8-18	214.0	192.0	1,819	1,718	3,537	75	4
32	8-31	173.4	177.5	1,734	1,819	3,553	78	4
33	8-24	301.4	300.0	1,808	1,785	3,593	86	4
34	8-15	146.4	147.3	1,779	1,834	3,613	81	5
35	8-25	221.9	217.2	1,864	1,759	3,623	88	5
36	8-20	55.0	53.7	1,837	1,788	3,625	70	4
37	8-12	51.0	53.4	1,749	1,896	3,645	65	4
38	8-26	158.2	193.9	1,661	2,046	3,707	84	4
39	9-2	211.0	164.0	2,078	1,665	3,743	87	5
40	9-1	140.4	121.3	1,966	1,935	3,901	81	4
41	8-18	191.4	199.8	1,847	2,058	3,905	86	6
42	8-27	202.5	192.0	1,954	1,978	3,932	81	4
43	8-24	267.2	245.1	2,031	1,912	3,953	90	5
44	8-19	298.2	302.4	1,938	2,056	3,994	93	5
45*	------------	58.0	51.0	2,625	1,436	4,061	----------	----------
46	9-5	148.6	138.0	2,170	1,980	4,150	80	5
47	8-26	156.4	158.9	2,018	2,137	4,155	89	5
48	8-16	215.7	219.5	2,017	2,151	4,168	86	4
49	8-19	185.3	184.7	2,066	2,124	4,190	79	4
50	8-18	300.9	293.0	2,151	2,154	4,305	91	5
51	8-1	254.3	242.3	2,250	2,072	4,322	69	4
52	8-16	179.9	179.9	2,204	2,195	4,399	94	5
53	8-9	309.7	323.0	2,152	2,277	4,429	91	5
54*	------------	273.4	261.2	2,297	2,155	4,452	----------	----------
55	8-15	283.2	301.3	2,266	2,320	4,586	89	5
56	9-1	186.6	195.8	2,174	2,438	4,612	95	6
57	8-27	248.0	252.0	2,306	2,344	4,650	90	5
58	8-26	217.2	212.9	2,367	2,299	4,666	92	5
59	8-22	386.8	355.5	2,417	2,275	4,692	92	5
60	8-20	241.0	294.6	2,121	2,592	4,713	92	5
61	8-25	218.0	265.6	2,125	2,603	4,728	93	5
62	9-3	471.8	454.6	2,477	2,682	5,159	100	6
63	8-9	257.0	277.2	2,621	3,035	5,656	91	5
64	9-6	270.6	306.4	2,625	3,033	5,658	105	5
65	9-3	379.0	370.3	2,994	2,981	5,975	107	6
66	9-2	115.5	102.2	3,407	3,061	6,468	79	4
67	9-5	311.2	338.6	3,781	4,165	7,946	95	5
68	9-1	232.5	515.5	3,225	5,181	8,406	105	5
Averages	------------	177.89	181.49	1,919	1,972	3,891	----------	----------

*Tag number lost.

3891 ova per fish. From the table it will be seen that 37 fish had more ova in the right ovary while 31 fish had more ova in the left ovary, which condition is just the reverse of that in the case of Snyder's series. This strongly suggests that the ovary of one side is just as likely to exceed in size and number of ova as that of the other side.

Figure 69 represents a frequency chart which combines the egg counts of Snyder's series with those of ours (a total of 98 cases). The class interval is 200 eggs. The broken line forms the "curve" resulting from the plotting of the actual cases; the solid line has been derived from the former by the process of "smoothing by threes."

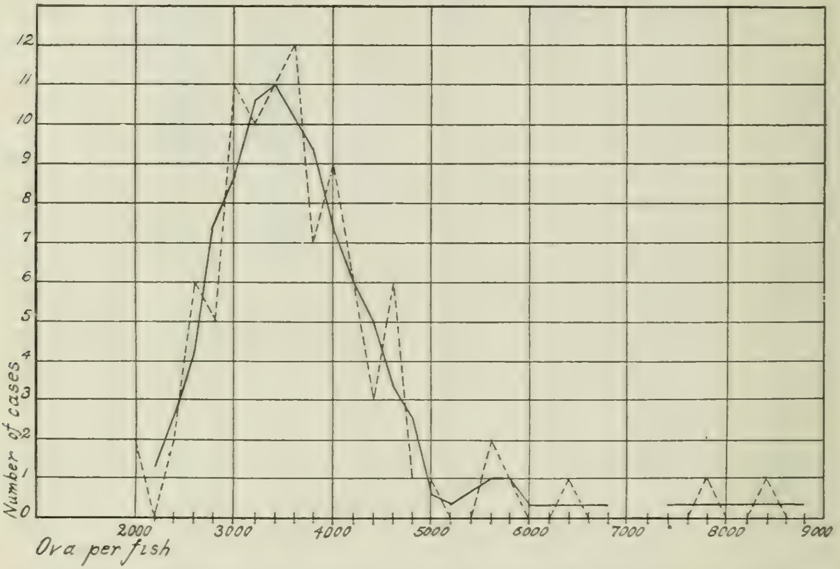

FIG. 69. Graph showing case distribution of the total egg counts of 98 king salmon from the Klamath River.

In the parlance of the statistician, figure 1 constitutes a very satisfactory frequency curve; that is, the great mass of the cases are dispersed rather symmetrically in regard to the mode. The mode is seen to occur at class interval 3400 to 3600 and does not coincide with the weighted average owing to a considerable skewness of the curve on the upper side, caused by a very few exceptional cases.

In figure 70 we present a graph again combining all of Snyder's cases with those of ours. A correlation is shown to exist between "length of fish" and "number of eggs." Each dot on the graph represents a case—98 in all. The continuous portion of the "curve" was derived from the case distribution by the process of twice "smoothing by threes." Beyond either extremity the "curve" is continued by a dotted line which connects with the most remote cases of the series.

It will be seen at once that a rather obvious "trend" exists. We believe that, were we in a position to plot the data from a very large series, the resulting "curve" would approximate a straight line connecting the lower left hand extremes with the upper right hand extremes.

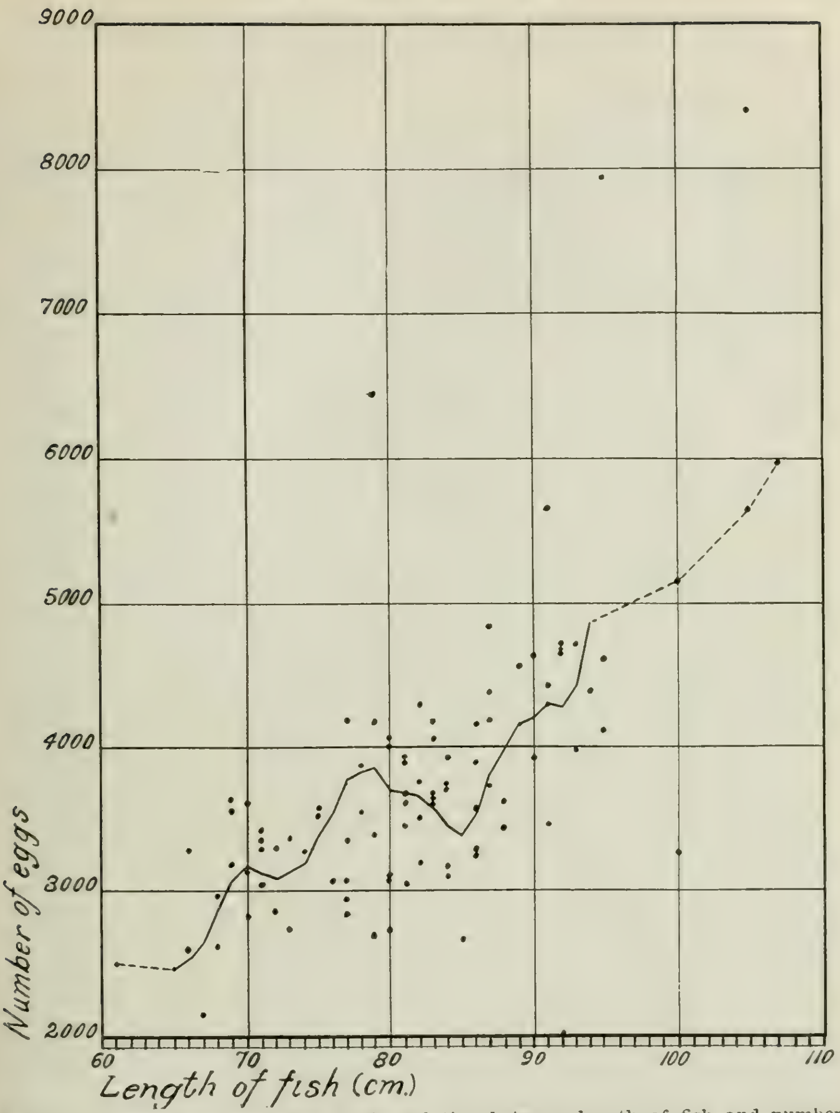

FIG. 70. Graphic representation of the relation between length of fish and number of eggs in the case of 98 king salmon from the Klamath River.

There are four or five cases which do not conform nicely with the mass distribution of the series. For example, one fish 105 cm. long possessed 8406 ova; another 95 cm. long had 7946 ova; while still another 92 cm. long had the fewest ova of any fish of the series—2013. Concerning these aberrant cases, all we can offer by way of explanation is that it is barely possible that these fishes belong to a race or races of salmon alien to the Klamath River or to unusual races native to the Klamath River. If the former hypothesis be true they may be either "stragglers" or fish that have become established through the transplantation to the Klamath system of eggs from other streams.

TABLE II.—Ninety-four Klamath River King Salmon, Tabulated to Show Relation Between Age and Number of Eggs.

Number of eggs (Class interval is 500 eggs)	Number of fish of different ages			
	3 years	4 years	5 years	6 years
2,000 to 2,500	1	1	1	
2,500 to 3,000	2	9		1
3,000 to 3,500		18	6	1
3,500 to 4,000		17	6	1
4,000 to 4,500		7	8	
4,500 to 5,000			7	1
5,000 to 5,500				1
5,500 to 6,000			2	1
6,000 to 6,500		1		
6,500 to 7,000				
7,000 to 7,500				
7,500 to 8,000			1	
8,000 to 8,500			1	
Totals	3	53	32	6
Mean	2,583	3,495	4,344	4,250

Table II is designed to present the data from 94 Klamath River salmon in such a way as to exhibit any possible relation between the age of the fish at maturity and the number of eggs. Such a correlation is actually seen to exist. The mean egg count for the three-year fish is 2583 ova; for the four-year fish, 3495 ova; for the five-year fish, 4344 ova; for the six-year fish, 4250 ova. Only six fish fall in the six-year group, and it is likely that a similar analysis of a much larger series of salmon would reveal that the average number of ova for the six-year salmon exceeds that of the five-year fishes.

Some years ago Mr. N. B. Scofield expressed himself as of the opinion that there is a considerable difference in the number of ova per fish as between the Sacramento River and Klamath River salmon. In 1902 Cloudsley Rutter of the United States Fish Comimssion[1] made the statement that "the average (Sacramento River king) salmon produces about 6000 ova." Mr. W. H. Rich, of the United States Bureau of Fisheries, informs us that the records of the Battle Creek Hatchery, together with his independent observations, indicate that the Sacramento salmon yield an average of about 6000 ova per female. Mr. Scofield's opinion seems to have been substantiated.

Such a study as that embraced in the present paper has both a zoological and an economic bearing. From the former standpoint it is patent that a careful diagnosis of a considerable series of individuals, with reference to such a fundamental biologic feature as the number of ova, is certain to be usable at some future time in matters where specific and racial relations are concerned. The most obvious economic application of our data lies in the contribution toward a knowledge of the relative prolificacy of the various races of salmon. Such a knowledge will have a very direct bearing on the operations of egg taking and spawning. By exercising a selective choice as between salmon races, it is not unreasonable to suppose that much good may thereby result in propagation practices.

It is to be hoped that the present study may be followed by others of a similar nature with reference to the Sacramento and possibly other salmon runs.

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[1] Popular Science Monthly, July, 1902.

THE FISHERIES OF CALIFORNIA AND THEIR CARE.

By WILL F. THOMPSON.*

The scientific investigations necessary for the care of the fisheries of California can not be understood nor formulated without some knowledge of the condition of these fisheries and their relation to those of other regions where investigations have been carried on. The brief presentation of the difficult material will, it is hoped, arouse interest in the really important problems to be faced.

The fisheries of California are recent in origin—that is understood by everyone as a natural result of the recent settlement of the State. But just how recent they are as really great fisheries, and how in that respect they correspond to the other great fisheries of supposedly much greater age, is very little known. They are in reality the result of normal influences acting throughout the world, although to the dealer or the fisherman their origin may seem connected with such phenomena as war or the depletion of other fisheries such as salmon. Whatever the specific causes of their beginning, there can not be much doubt but that a place existed for them, or they could not have arisen to their present height.

The progress of exploitation of our fisheries has been slow and steady until recently. In 1880, at the time Dr. Jordan made his survey of our coast fisheries, they existed, as he said, mostly as possibilities. Other surveys were made in subsequent years, as 1889 to 1892, 1904 and 1908, and some growth was noted. Then in 1915 the Bureau of Fisheries figures indicated a great rate of increase. And since 1915 the annual summaries of the California Fish and Game Commission have shown, on the whole, a surprising enlargement, especially of the total used for canning. (Fig. 71.)

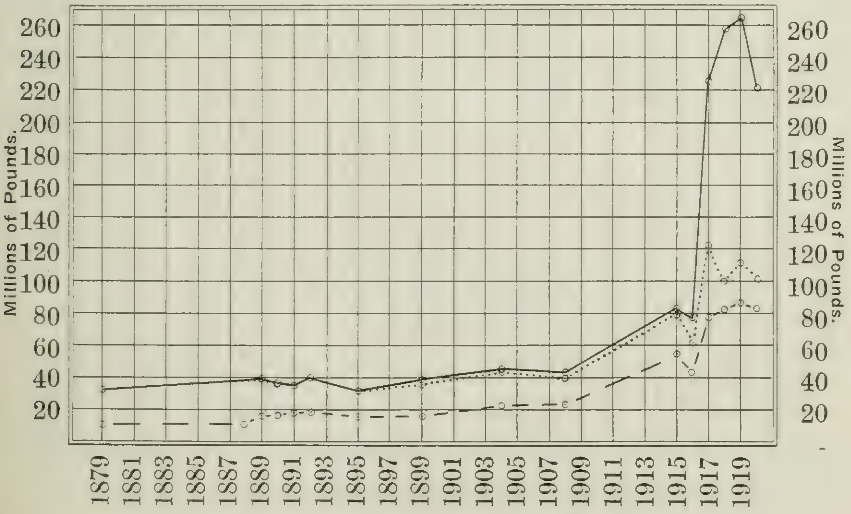

Figure 71. Growth of California Fisheries.

——— All marine fishery products except Alaska cod and oysters.
. . . . . . Same, less sardine.
- - - - Fish only, less salmon, cod and shad as well as sardine.

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*A report made to the Committee on Conservation of Marine Life of the American Association for the Advancement of Science. The assistance of Frances N. Clark in the collection and preparation of data used in this report is gratefully acknowledged.

Not merely does the grand total show a rise, but those for the individual species have climbed steadily. Attention should be called, for instance, to the barracuda, the consumption of which can not even remotely be called of war origin or temporary in nature. Vastly greater amounts have been used in the more recent years, as is shown by the accompanying chart. (Fig. 72.)

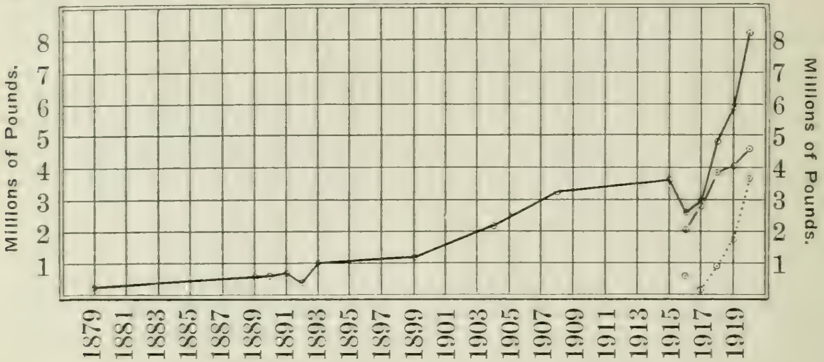

Figure 72. Barracuda Landed in California.

———— Total landings.
- - - - - From California waters.
. . . . From Mexican waters.

But aside from this general increase, other things have been happening in California waters. One of these is the steadily falling importance which the mollusk and crustacean fisheries show, contrasting with the rise in the catch of the marine fishes. The exploitation of the mollusks, such as the abalone for jewelry, and the shrimp for fertilizer in China, were what one might call freak fisheries, for easily obtained products, to satisfy a demand that already existed—one to small extent only dependent upon the population of our country or its transportation facilities. These fisheries shortly reached their

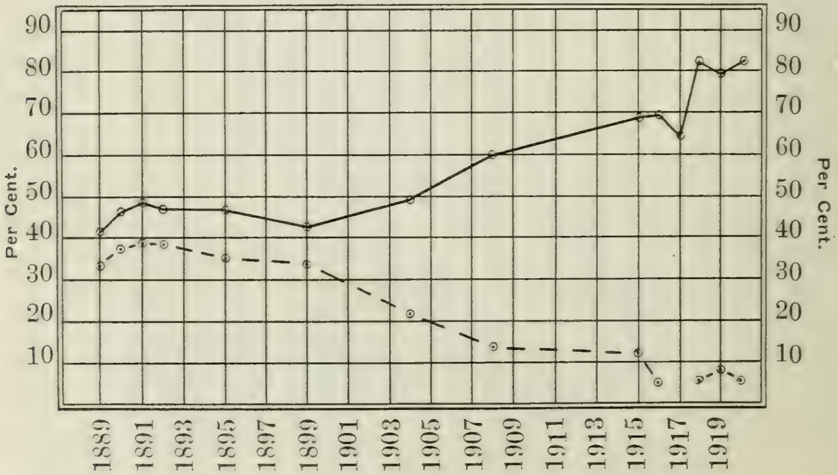

Figure 73. The Percentage Certain Categories Form of all Marine Fishery Products, Except Alaska Cod and Oysters, Landed in California.

———— Fish, less salmon and shad.
- - - - - Crustaceans and mollusks.

climax, and have recently sunk both absolutely and relatively to minor importance as compared to the fishes used for food. The phenomenon is one indicating the maturity, in a certain sense, of our fisheries, when the great and growing demand for foods asserts its rightful place over the incidental demands which have run on before. (Fig. 73.)

Another phenomenon to which it will be well to call attention is the fact of the actual failure of our own waters to produce a sufficiency. The spiny lobster is an instance of this, as the accompanying graph will show. Since in the early statistics it is impossible to separate lobsters of Mexican origin from the relatively very few landed in San Diego from California waters, one category has been formed of Mexican plus San Diego lobsters and contrasted with those from other counties of the State. The invasion of Mexican waters is well illustrated. Another instance of the same is the barracuda, likewise shown in a graph. The demand for these fish is being satisfied to an increasing extent from Mexican waters, although here the adequacy of the available statistics may well be questioned. The fact, however, is clear, that a process which has occurred in other older fisheries has begun here, namely the outgrowth of the domestic supply by the demand, so that fishing grounds farther away are being used. It will be interesting to see how far the process, which in Europe carries fishermen to the Barents Sea and to tropical Africa, can and will go. It very probably will be found to accompany over-fishing of our own grounds, as it has in European waters.

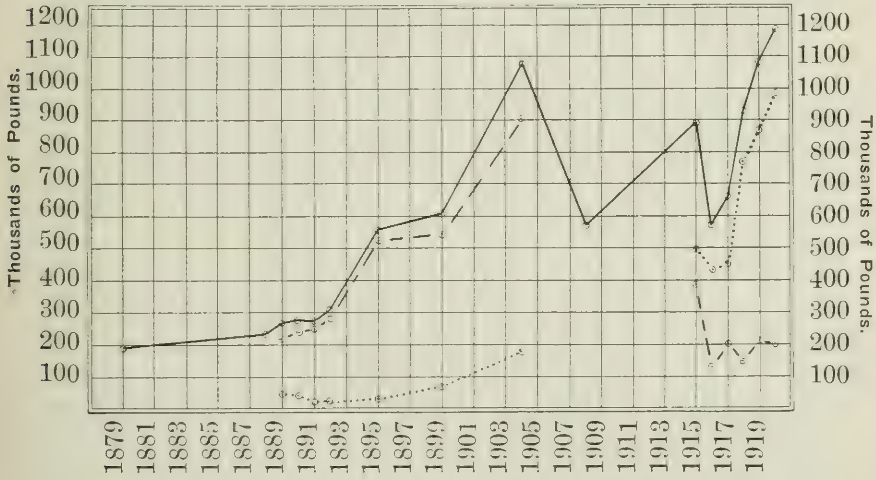

Figure 74. Spiny Lobsters Landed in California.

———— Landed at all ports.
. . . . . . Landed San Diego and Mexico.
- - - - - Landed other California ports.

It seems, from what has been presented that our fisheries are of not merely recent, but very recent origin. In certain individual cases, there seems not to have been time yet for over-fishing to have shown its effects. The young born while the fishery for barracuda was still small have barely come to full maturity. Their abundance, therefore, can not have become very seriously affected yet. But the question is not what has happened but what will happen. That the future is more than doubtful can be demonstrated.

If trouble were afar, and it were possible safely to say, "Let us overcome that problem when we get to it," this report would not carry much weight for the ordinary man. But there is every reason to believe that the problem is near at hand. Our fisheries have advanced farther than we have perhaps dreamed. Indeed, in the flush of their youth and the existence of a rich accumulated reserve, they have perhaps gone too far. The biologist should be in a position to eliminate that *perhaps*, and to put either *not*, or *certainly* in its place. It is a tribute to the slight interest that is taken in practical biology that not even an attempt has been made.

How far have our marine fisheries really gone? For answer we might make a comparison with such fisheries as those of Europe. They are popularly believed to be the most ancient and most extensively exploited of any, but a comparison is difficult, as we shall see. Should we compare our fisheries in California with those of a restricted area like that of the North Sea, or with those of all the seas to which European vessels go? Should the basis be the area of the coastal banks within the 200-metre line which is commonly accepted as limiting most great fisheries? Or should it be the length of coast line because the vast body of the ocean determines the abundance of the fish? Pelagic species might be compared on a basis of coast line, demersal on a basis of fishing banks, but demersal species are dependent upon pelagic animals, and pelagic animals in good part upon the coastal waters. Certainly the truth seems to be somewhere between the results obtained by comparison of length of coast line and area of fishing banks.

To obtain some basis for comparison, let us for the time being adopt the conclusion generally held sound, that all great fisheries are very largely limited by the extent of the coastal waters and the area of the banks within the two hundred metre line. The albacore ranges well beyond that, as indeed the sardine does, but that does not necessarily invalidate the applicability of the rule, which certainly seems to hold for demersal or semidemersal fishes.

The North Sea is for the greatest part within the two hundred metre line and has an area of 152,500 square miles (geographic) according to the International Council for the Investigation of the Sea (whose data will be used unless otherwise stated). The crest of this production was reached for the time being, in 1913, just before the great war, and it will be legitimate to compare that with our maximum year in California, 1919. The catch in our waters was about 125,000 tons, in those of the North Sea 1,408,000, a ratio of one to eleven. But the area within two hundred metres is, off the whole coast of California, but about 7500 square miles, in the proportion of one to twenty to that of the North Sea. In other words our waters seem to be producing nearly twice the amount per square mile.

If the seas of the Atlantic coast of Europe, with the Baltic, Barents Sea, the White Sea, and the Moroccan Coast included, minus the area within the three-mile international limit, are considered, a total of about 700,000 square miles is found (Board of Agriculture and Fisheries for England, 1906). The total yield in 1913 was 3,077,000 tons. The ratio between the California area and the above area is one to ninety-three, of the catches one to twenty-five. Hence three and seven-tenths as much per square mile is taken from our waters.

The question then arises as to whether the fisheries are really comparable, and as to the relative part the pelagic fishes play in the total. One may compare the herring, the sprat and its allies in Europe with our sardine and herring, and find that 64.4 per cent of the catches in our waters are composed of these species, as contrasted with 67.1 per cent in the North Sea, and 45.2 per cent in all Northwestern Europe. It would seem clear from the comparisons that our use of the herring-like pelagic fishes is extensive, but not much more so than that made in European seas.

In so far as the remaining species are concerned, the cods take the place of our mackerel-like fishes if to our mackerels are added the larger round predaceous fishes such as the barracuda and the salmon. The following table illustrates this:

	North Sea	European Seas	California
	Per cent	Per cent	Per cent
Flatfishes	5.9	4.7	3.7
Herring-like fishes	67.1	45.2	64.4
Cods	21.5	39.8	----
Large round fish	----	----	10.7
Rockcods	----	----	2.1
Mackerel-like fishes	1.9	2.4	17.4
Sharks	.9	1.2	.4
Small fish	1.0	1.8	.9
Miscellaneous, unclassified	1.8	5.0	.4
Totals	100.1	100.1	100.0

The compositions of the catches in the two areas do not vary widely in their essentials, and the relative intensity of fishing holds as much in the comparison of the minor groups as it does for the entire. Thus in the case of the flatfishes, the most typically demersal, the percentages do not vary widely enough between the areas to change the conclusion as to relative intensity deduced from the comparison of the entire fisheries.

The comparison might justifiably be ended here, if it were not possible that the use of such areas as a basis is an error. And, indeed, if the length of coast line of Atlantic Europe is used as a basis for comparison, the proportion of coast line (including the Baltic with its large herring fisheries) is roughly one to fourteen, as contrasted with that of the catch of one to twenty-five. Yet such a comparison errs at least as far in the other direction as does the use of areas, for it is very widely accepted that the North Sea is a very important part of the whole and that it owes its importance to its most remarkable area of shallow water banks, seemingly highly suitable for the production of the cods and flatfishes.

A more valid objection to the comparison of areas is the fact that in California the so-called pelagic fishes bear more of the burden than in Europe. To meet this a comparison may be instituted between the catches of pelagic fishes such as the mackerel and tuna, the sardines and herrings. There may then justifiably be added the albacore and tuna fishes—as representing the mackerels—to the sardine, and very probably the salmon fisheries are also properly pelagic. The "pelagic" fisheries then become as two is to twenty-seven, as contrasted with coast lines of two to twenty-eight (very approximate). In other words the pelagic catch is nearly the same per mile of coast line.

Such exactness in comparison is very obviously not justifiable, as any biologist will see numerous objections and limitations to it. Prominent among these is the probable difference in productivity of the oceanic waters. But the point must be apparent that our fisheries, to be comparable at all, must have reached a high degree of development. And they probably are at present yielding more than the North Sea fisheries in proportion. What is the significance of such a fact, and where its danger?

The danger is for the most part in ignorance and lack of foresight. Our fisheries are steadily increasing. They will continue to increase just as fast as our population does, and every perfection of transportation, of preservation, or of marketing will add to that population increasingly large numbers from the inland peoples. The building of great cities with their dependence upon imported produce, and the industrializing of whole nations will enlarge the proportion of people dependent upon such sources of food as the sea. So the whole of modern civilization indicates increasing use of the resources of the ocean, and unless one lacks faith in the progress of the world, those resources must be conserved. The yield from the fishes can not be doubled every ten years and the limit not exceeded.

The sharp and recent rise in intensity of our fisheries is but a variation in the general rise taking place everywhere throughout the world. In the North Sea, where depletion is accepted as occurring and as proved at least in certain lines, the exploitation of the sea really began in 1880 or shortly thereafter, when steam first came to be used in vessels. Then in 1895 the otter trawl opened to the fishermen depths below fifty fathoms, and since then successive improvements have increased many times the efficiency of the gear used. The really great North Sea fisheries are in fact very recent, and those of the other seas of Europe still more recent. That depletion should come in this dawning of the era of exploitation is ominous to us, for there is no reason to suppose our fisheries immune from similar consequences.

There should not be any doubt in the minds of reasonable men that the North Sea has been exploited to its limit, and beyond in many respects. That is especially true of the plaice and the haddock. But there are two things concerning the North Sea and indeed all fisheries that need emphasis. One of these is the lack of data which indicate the condition of the fisheries previous to the last ten years. The other is the vast amount of labor now required to obtain a yield as compared to what is necessary in a virgin fishing area such as ours still is. This may be illustrated readily.

A pair of small steam tugs dragging a paranzella net with 50-foot spread catches off San Francisco an average of 6500 pounds per day, making two hauls of two hours each. But a modern steam trawler takes only 1700 pounds per day in the North Sea (Jenkins, The Sea Fisheries p. 158), not much over a fourth of the California catch, despite the far more efficient apparatus, and the practically continuous day and night fishing. It would seemingly be conservative to estimate the abundance of fish in the North Sea as not a tenth what it is on California grounds, in view of the differing efficiency of the gear.

It therefore seems justifiable to scientists far removed from the heat of the discussion to conclude that the North European Seas are really well along on the road to exhaustion while those of California are in comparison relatively unharmed, and a careful perusal of the existing data does nothing to shake such a conclusion. True enough, the evidence of depletion is in part unable to bear critical scrutiny, being highly complicated and defectively gathered. But the discovery that the existing evidence is faulty as regards many of the species investigated, provides no proof that over-fishing has not occurred, nor a lessening of the significant indications. On the contrary, it seems that depletion must be proceeding rapidly to provide even the proof that is obtainable in the welter of complications.

From such consideration as has been given of what has happened elsewhere during this world wide increase in intensity of fishing, it is possible to see where the danger lies for our California fisheries. Will they continue to grow without observation, and will there come a time when we will not know even remotely whether our fisheries are approaching exhaustion? That is exactly the state of affairs in Europe and may well be here.

Exhaustion does not necessarily become obvious to everyone when it occurs. The cost of catching fish is but a fraction of the cost of distribution. Thus the fisherman may receive eight cents per pound, where the retailer asks forty cents, and doubling the fisherman's price would add but a fifth to the retailer's price. The consumer is, moreover, willing to pay high prices for a product to which he has become accustomed, and the rarer it is the more he will pay. But there are, in addition, influences which actually counteract the effect of increasing scarcity in raising the initial cost. The accompaniments of that intensified exploitation which results in depletion are the constant broadening of the fishing grounds, the inclusion of more than one species of fish and of inferior quality in the catch of the boats, the development of means of preservation, the constant improvement of gear and the increase in quantity of apparatus. All these things tend to eliminate the great and sudden fluctuations in amount of yield which are characteristic of fisheries confined to one species or one locality. These variations in yield render the exploitation of the fisheries expensive and uncertain because the periods of abundance must be made to pay interest upon the capital and to maintain the organization during periods of scarcity. Their elimination as a result of intense fishing undoubtedly does reduce the cost of fish to the consumer, perhaps to the extent that for a while the influence of depletion in raising the initial cost will not be felt.

But in the end that very fact may defeat the natural safeguard which should protect a species, namely the lack of profit in carrying on a fishery when it comes dangerously near to exhaustion. It becomes possible to prolong a fishery because other species are taken; the by-product becomes the mainstay of the business and the depleted species is kept under a strain for which it could not itself pay. If it were not for cod, perhaps the halibut fishery of Iceland might have long since collapsed; and if it were not for the cheaper round fishes, the flat fishes in the North Sea might be pursued far less rigorously. On the Pacific Coast, the tuna and sardine fishery of California may have been of considerable assistance to the albacore fishery. In fact, the objection often raised to the possibility of over-fishing, that the fisheries are prospering and that they would immediately cease to prosper should depletion in any one species occur, is not a valid one. But that they would ultimately fail as a result of over-fishing seems sure.

We have seen that our fisheries have recently undergone a very marked development paralleling that occurring elsewhere in the world, that their intensity equals or exceeds that in older over-fished areas, and that there is every reason to anticipate over-fishing here. In addition we have seen that it is necessary to keep data which will prove the condition of the fisheries. What the nature of that data is can be stated confidently from the experience of those men who have investigated the North Sea.

NATURE OF DATA NECESSARY.

Although the nature of the data necessary can be stated confidently, it is not easy briefly to define their extent and their complexity.

The primary requirement is knowledge as to the relative abundance from time to time of the fishes concerned. The actual abundance is out of reach of ascertainment, but an index to the changes therein is possible. And the first as well as the most ignored of the connected problems is the efficiency of the measures utilized. The taking of experimental catches by special apparatus has proved both expensive and futile and the general consensus of opinion is that the commercial catches furnish the best evidence.

But the commercial catches are the result of many factors, among which are the changing of gear with the years, the use of vessels of increasing efficiency, and the use of grounds farther afield. Such factors may be avoided by competent statistical methods.

In addition there are well pronounced meteorological and oceanographical influences affecting the catch and the fishes themselves, to an extent undreamed of by a person unacquainted with the fisheries. No avoidance of the effects of such is possible, save by the gathering of data over periods of time of sufficient length to allow the influences to counterbalance each other and reach a stable average. It is well known that successive years are more truly comparable through their averages than through identical months or days, because although the returns for the latter fluctuate widely, they tend to vary above and below, and around a mean. The study of how extensive the statistical records must be to present a true picture is one of the major problems which must be attacked.

After the solution, or the approximate solution of such problems, there remains the question of the significance of the actual changes in abundance discovered. In various fisheries there have been found great natural changes seemingly entirely unconnected with man's influences. So that one of the greatest problems to be faced is the distinction of such widespread variations and the effects of over-fishing. As Hjort has indicated in the case of the herring, and as we may find in our sardine, the spawning of a given year, say 1910, may provide the fish in the commercial catch for ten or twelve years, and the fishery may rise and fall in accordance with the growth and disappearance of that class. A careful theoretical consideration of the possible criteria for the separation of such phenomena from the effects of over-fishing, has still to be made, and in addition, these criteria must be tested.

But there is one fact acknowledged and capable of use in such separation, namely that over-fishing diminishes the abundance of the older fish, whereas during natural fluctuations a certain cycle of changes occurs. For the use of such a criterion a direct age assessment is necessary, or failing that a size assessment. That implies, both for the purposes of age or size assessment, and for the correlation of the discovered changes with physical and economic phenomena, an accurate knowledge of age and rate of growth. That is a purely biological problem of considerable difficulty, but it also involves a knowledge of annual migrations sufficient to assure the investigator that he is not drawing his material from varying sections of a population undergoing differential migration according to age.

The above are the essentials in the immediate care of the fisheries. There are omitted the investigations of such problems as the spawning periods, the existence of races according to locality, and similar facts which may be assigned as causes for various effects observed. The biologist can not omit them from his investigations, simply because of their utility in the formulation of theories and the explanation of facts, not so much because of their direct importance; but they should be assigned a purely secondary place in the work of preservation of our fisheries.

Finally, there are the problems connected with remedial legislation. These are mainly concerned with two things, one economic, the other biological. One is the existence of waste which may possibly be eliminated, to the benefit of the species, the other is the relative worth of protection to the various stages of the life of the fishes. Protection may be assigned at any stage for the actual purpose of reducing the catch, but the psychology of the public demands that some such ostensible reason as the capture of spawning or of immature fish be used. In so far as possible a really rational basis should be substituted for such totally unscientific ones, and this rational basis will seemingly demand a knowledge of rate of growth and of the death rate at various periods.

It will be seen from the above that the work to be done is of a more or less practical nature, interpreted from a background of biological and oceanographical knowledge. The more perfect this background the more perfect the practical results. So that it becomes a matter of first importance that the general biology of the fishes and the varying conditions in their environment be thoroughly investigated.

INVESTIGATIONS NECESSARY.

An indispensible basis for the study of our fisheries, both from the point of view of over-fishing and of the greater fluctuations which occur, is a system of statistics. It should be far more perfect than the ordinary compilations that masquerade as statistics, and should be collected by the biologist.

The first requisite of such a system is the provision of some measure of the relative abundance of the fishes concerned. The unit by which such abundance is measured must be a constant one, as far as possible, and it has been found that such units are difficult to find and variable according to the fishery. In the case of otter-trawls, the catch per hundred hours of fishing with a certain type of trawl; in the case of trawl lines, the catch per unit length of gear run; in the case of boats trolling for pelagic fishes, the catch per day of a given type of boat.

In other words a perfect statistical measure of abundance would depend upon the particular fishery investigated.

That, however, is plainly out of reach. Some less perfect measure, the error in which can be counteracted by the collection of sufficient data, must be substituted. In the case of our California fisheries, the same gears and vessels will in the long run tend to be fished to their full capacity to make them pay, or the variation in the way they are used will be relatively little from year to year. A careful record of boats, their gear and their catches is therefore reasonably good for the purpose of gauging the relative abundance of fish from year to year.

1. It is therefore proposed that the statistics to be gathered cover such details, and that the catches of the *individual* boats be compared from year to year to show the variation in yield. The comparison of individual boats is emphasized because it is obviously wrong to compare the catches of different boats. The changes in numbers of vessels, type of gear used, total catch, etc., and the market demand, should be incidental to this.

The method of collection of these statistics should be rendered as free from the personality of the collectors as possible. The completeness of the data obtained should rest neither upon the shrewdness nor the affability of the man in charge. It would be far better to have a uniform error year after year than a change from complete to incomplete as the personnel concerned change. In other words the collection of statistics should be systematized to act automatically and should be enforced by law. An illustration of the possibilities and feasibility of such a method is to be found in the present system of the California Fish and Game Commission.

It need hardly be necessary to point out the desirability of joint international action in the collection of such statistics. The United States-Mexican boundary line is conveniently placed for assisting in determining the points of origin of the catches.

Such a system of statistics may be made automatic, and its results filed away for reference.

2. The collection of special statistics should supplement this system and be applied to any fisheries threatened. An instance is to be found in the albacore fishery. In that there should be (*a*) a continuous record of the shifting locality of the fisheries, and (*b*) a series of measurements or age determinations throughout the season to determine the relative frequency of the age classes. One man could follow both the sardine and albacore fisheries, and perhaps the barracuda fishery from a given point, as San Pedro.

Such data should show the range of the fishery, and its expansion. Also the exhaustion of successive localities.

The age or size assessment should show the diminution in average size which is supposed to be an earmark of over-fishing. It has been much used, for instance, in the case of the Plaice fishery of Europe and has been found to hold for other fisheries, such as the halibut. From it also could be determined the presence or absence of fluctuations due to the relative success of the spawning seasons, a matter of great importance, as Hjort has shown in the case of the herring.

3. The biology of the fishes concerned should be studied to direct and supplement the above work. The most needed facts are those as to

rate of growth, the migrations, and the causes of variations in abundance.

4. The first three divisions are those which are directly necessary for the care of our fisheries. But the adequate explanation of their fluctuations and an understanding of the more fundamental biological aspects of the fisheries undoubtedly depends upon a knowledge of the ocean, its currents, its contained life and the changes therein. The investigation of such facts should be carried on by those agencies not directly responsible for the observation of the condition of the fisheries, although certainly the latter should also aid where possible.

The specific investigations immediately necessary for the preservation of the California fisheries have been already undertaken by the State. It should be granted, under present conditions: (1) Support in the maintenance of its present program, and (2) representation in any organization designed to further the investigation and conservation of the fisheries, such as should be formed to bring into harmony the efforts of the various states, and the national government.

The more general investigations urgently needed for the enlightened and scientific care of the fisheries include the following: (1) The determination of the ova of our fishes, the period and direction of their drift; (2) the measurement of the amount of migration of our pelagic fishes, including a comparison from a racial or specific standpoint of the larger mackerels in California, Hawaii and Mexico; and (3) the recording of the oceanographical changes which may be correlated with the fluctuations in the abundance of fishes shown by the statistical and biological investigations. For these investigations ocean going vessels will be necessary, and their provision, as well as their program, must be determined by experts in conference.

In closing, it may be proper to summarize in a sentence what has been said. A science of vital statistics is proposed, and the basis for it must be governmental action founded upon biological knowledge.

APPENDIX.

DISCUSSION OF TABLE AND GRAPHS.

The statistics shown in the appended table are drawn from the reports of the United States Bureau of Fisheries until the year 1915 inclusive. It is highly regrettable that they are scattered and irregular in point of time although the general trend of the fisheries is illustrated. Moreover, their method of collection is not that which is recommended in this paper, and naturally the writer does not have any great faith in their freedom from error.

The data obtained for the years 1916 to 1920 inclusive are taken from the reports of the California Fish and Game Commission. With regard to these, it must be pointed out that the statistics for 1916 and 1917 were collected in a different manner and are much less dependable than those for the three later years. For example, to what extent the seeming fall in 1916 is due to defects in the method of collection, either of the United States Bureau of Fisheries in 1915 or the California Fish and Game Commission in 1916 and 1917, is now impossible of ascertainment. It is therefore apparent that really accurate statistics are obtainable for but three years, including 1920. But the earlier data are surely sufficient to illustrate the general tendencies shown in the total catches of the various fisheries.

As the purpose of the table and graphs is to illustrate the tendencies of the native marine fisheries, various categories of returns ordinarily included are omitted. Thus the cod bought from Alaska is everywhere subtracted, as are the oysters because they are cultivated and imported as spat. The anadromous salmon and shad are omitted in some instances because the first have been the object of special long established river fisheries, and are aided by hatcheries, while the second species was transplanted from the Atlantic. Sardines packed in California showed very great changes due to war conditions, and their use may be regarded by some as not a part of the normal growth in our fisheries. In figure 1, provision has been made for those who prefer to ignore this fishery, and the increase in our fisheries is demonstrated without it.

It remains to call attention to the difficulty faced in distinguishing barracuda and spiny lobsters from Mexico. The figures obtained at present are probably much more nearly correct than those obtained previously. In fact no provision seems to have been made in the Bureau of Fisheries figures for Mexican importations. For that reason the spiny lobsters landed in San Diego have been all regarded as Mexican in origin, simply to emphasize the southward movement of the fishery. (Fig. 74.)

The treatment of these statistics summarizes practically all that is known concerning the increase of our California fisheries. It is exceedingly regrettable that the record is so imperfect and that it is confined to the total catch alone. No correlation of the changes with the great increase in the population of California since 1905 has been attempted, although the comparison is inviting and the connection between them seemingly intimate.

MARINE FISHERY PRODUCTS OF CALIFORNIA, 1879-1920.

	1879	1888	1889	1890
Marine fishery products, less cod and oysters	*31,249,020	------------	37,995,521	36,257,047
Sardines	900	5,140	1,097,397	1,314,800
Fish, less salmon, cod and shad	8,578,200	9,735,726	16,267,043	17,659,322
Mollusks and crustaceans, less oysters	6,661,100	11,609,755	12,415,769	13,136,555
Barracuda, including Mexican	200,000	------------	500,714	511,078
Spiny lobsters, including Mexican	190,000	**231,061	266,458	278,310

*Includes Alaska cod. **Doubtful.

	1891	1892	1895	1899
Marine fishery products, less cod and oysters	35,014,133	38,636,594	31,820,131	39,073.122
Sardines	937,563	752,964	732,293	2,383,000
Fish, less salmon, cod and shad	17,512,927	18,567,258	15,258,543	18,040,112
Mollusks and crustaceans, less oysters	13,095,216	14,634,809	10.953,895	12,387,114
Barracuda, including Mexican	694,793	326,804	979,674	1,191,505
Spiny lobsters, including Mexican	272,245	303,275	558,054	606,713

	1904	1908	1915	1916
Marine fishery products, less cod and oysters	44,691,978	43,236,000	82,978,228	77,717,266
Sardines	1,036,470	4,638,000	4,389,103	15.402,578
Fish, less salmon, cod and shad	22,615,811	27.549.200	58.475.366	58 610,295
Mollusks and crustaceans, less oysters	9,370,008	5,267,000	9,823,987	3,228,269
Barracuda, including Mexican	2,159,282	3,205,000	3,592,646	2,589,653
Mexican barracuda				571,792
Spiny lobsters, including Mexican	1,078,065	573,000	892,392	572,536
Spiny lobsters from Mexico and San Diego				341,026

	1917	1918	1919	1920
Marine fishery products, less cod and oysters	225.910,101	257,909,441	264,744.525	220,729 600
Sardines	105,098,112	157.652,811	153,877.179	118.520 914
Fish, less salmon, cod and shad	183,444.843	240,589.110	241,227,821	202.775 812
Mollusks and crustaceans, less oysters	23.883,931	5.472,728	8,797.410	5.386.385
Barracuda, including Mexican	2,956.812	4.837,284	5,824.957	8.201.335
Mexican barracuda	165,115	951,593	1.786,105	3,615,947
Spiny lobsters, including Mexican	659,318	930.827	1,089,465	1.189.196
Spiny lobsters from Mexico and San Diego	255,444	735,077	832,571	942 020

THE CATTLEMAN'S RIGHTS.

By Roy M. Hagen, Secretary Cailfornia Cattlemen's Association.

The range cattlemen of the state are much disturbed over the annual loss of cattle due to the carelessness of deer hunters which seems to be increasing year by year. Not only are cattle actually killed and seriously wounded by careless hunters in the mountains, but perhaps even more serious than this is the manner in which cattle are driven from the range by the tremendous number of hunters who go into the hills and camp at water holes, depriving the cattle of necessary water and permitting their dogs to chase cattle to the extent that cattle are often driven from the high mountain ranges to lower elevations where poorer feed conditions exist, sometimes as much as six weeks before they normally would work to lower elevations. It has been conservatively estimated that this disturbing of cattle by hunters camping at water holes and by the use of dogs, causes a loss of between $2 and $3 per head annually.

There never was a question which did not have two sides with considerable logic and good reason on both sides. It is not the desire of the cattlemen to secure the passage of any laws which will unduly restrict the activities of hunters or vacationists in the mountains. The cattleman feels that the public has a right to these privileges, but he also stoutly maintains that he is entitled to consideration and that his property must be respected.

It is unfortunate that a comparatively small number of hunters cause most of this feeling on the part of the cattleman. It is undoubtedly true that the majority of hunters use discretion and a reasonable amount of common sense while in the mountains. It is the few who fail to respect property, who kill cows, steers and more particularly calves, who cut fences, who intentionally drive cattle away from water holes, and who leave gates open, who are responsible for the present feeling and who will be responsible for any necessary restrictions which may possibly be forced on all hunters in the future.

It is probably true that the average cattleman does not fully appreciate what is done in his behalf by the Fish and Game Commission. This Commission is constantly endeavoring to secure the passage of reasonable laws which will be possible of enforcement and which will protect game and the rights of cattlemen at the same time. Probably comparatively few cattlemen know that the $2 paid for a hunting license by each hunter, goes into a fund for the paying of a bounty on mountain lions which are killed. The Fish and Game Commission is the only organization in the state which pays any bounty on the killing of mountain lions. Each year there is an average of 260 mountain lions killed on which a bounty is paid. It is quite possible to estimate that each lion would account for five head of livestock annually, or in other words, a saving of 1300 head of cattle annually to the cattlemen in the state. This saving of 1300 head of cattle by the killing of mountain lions goes a long way towards offsetting the 300 or more head of cattle killed annually by careless hunters, but that is not the whole question as pointed out above. There are approximately 150,000 head of cattle ranging on national forests in the sections of the state most frequented by deer hunters. Let us suppose that one-half of these cattle are disturbed by hunters and that the loss from such disturbing is $2 per head annually. This means a loss to cattlemen of $150,000. The saving to the cattlemen through the killing of mountain lions could possibly be estimated at about $75,000, which leaves a net loss to the cattlemen of $75,000 annually, as a result of the careless gun of the hunter and the unrestricted use of dogs.

It can not logically be expected that the cattleman will sit by and accept this loss without a word of protest. The cattleman pays for the use of his mountain summer range, and feels he is entitled to the use of that land for the entire season. If his cattle are driven from that range, he not only fails to receive what he has paid for in pasturage, but his cattle fail to make the proper gains and he is forced to provide feed for them at lower elevations which is an added expense.

As evidence of the fact that it is the few reckless hunters who spoil the privileges of the conservative hunters, I wish to state that I have in my office a bell taken from a cow coming from the range in the fall of 1921, which bell has a bullet hole through its center. It can be readily imagined that two "wild Indians" possibly in the mountains for the first time, ran out of interesting targets, and one of them said to the other, "Watch me ring the bell." Whereupon he promptly "rang" the bell. Of course, if all hunters were equally good marksmen, the loss of cattle would not be as great, but unfortunately too many such men "rang" the cow and not the bell. It can be easily understood that the cattleman owning that cow from which such a bell was taken, will not be kindly disposed towards hunters on his property, and during the coming deer season some hunter will probably fail to understand the hostility with which he is greeted by the cowman who runs across him on his range.

Since it is the few who destroy the privileges of the many, I have but one suggestion to make, and that is that the hunters themselves should try and personally live up to the "reminders" printed on the back of each 1922 hunting license, and insist that every other hunter should do the same. It seems to me that this is absolutely necessary if the pleasures now enjoyed by the hunters shall continue without curtailment. It is not logical to expect that the cattlemen will continue to accept the losses and inconveniences caused by hunters, which, from their point of view, are entirely unnecessary and unjustified, without a very serious protest. The tension can be greatly relieved by the cooperation of the hunters themselves. Remember the things on the back of the hunting license. Let the hunter put himself in the position of the cattleman, then practice the Golden Rule, and the hunter will be able to enjoy his hunting privileges for a much longer time than if some other policy is followed.

POSTED PROPERTY AND A SOLUTION OF THE HUNTING PROBLEM.*

By Captain Frank Winch.

Rod and gun clubs dot the horizon of America, and their name is legion. Ordinarily, their tenure of life can be measured in inches on the yardstick of time. A few fellows get together and decide to create a club. Officers are elected, an assessment is levied to give the right tone and color to the treasury. The layout, then, from the average angle, is complete. For the next six months or so, the club functions after a fashion. Then happens the inevitable. One member drops out, then another, and more until only a few of the standbys, honest-to-goodness-gun-cranks, encircle the bewildered secretary and ask "what's the matter?" The answer not forthcoming, more guns desert the locker, and in the finality we find the remnants of So and So Rod and Gun Club only a shattered wreck of hopes, the sign comes down and the whole thing is cobwebbed in reminiscence.

Why?

To my mind the crux of the situation lies in the fact that we build our structure from the top in place of starting at the bottom. We overlook a fundamental without which no club ever has been or ever will be successful. We make every preparation for the hunt in the matter of clothes and sporting impediments, but we contribute to a fateful negligence when we are remiss on the subject, "How to Hunt Posted Property."

Every sportsman who has gone afield has had the solution of this situation at hand. We have had the posted property thing thrust at us, glaringly, and impressively on every milestone of our journey. Once solve the question of hunting posted property and you have rendered to the *n*th degree of simplicity the successful career of your rod and gun club.

Posted signs are more generously sprinkled about than the stars in the milky way, and the tendency seems to be headed toward trespass warnings on what little ground has been overlooked. There are certain states where it is impossible for the stranger to hunt unless he places himself in the middle of the public highway and risks a shot between glares of the observant farmer on either side of the fence. Reducing the problem to its elementals, you will find that the farmowner and the landowner is the barrier that stands between your club's success or failure.

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*From Sacramento Union, January 29, 1922.

Right here permit me to emphasize a point—the farmer and the landowner have found ample justification in posting their property. Broken fences, undone gates, injured stock and in many instances depredations and vandalism as surprising as they have been costly, sponsor the attitude of the farmer in keeping city sportsmen from his domain. Without a place to hunt and fish, without an interest by the hunter and angler in the propagation and conservation of game, without the good will of the farmer, the rod and gun club curls up and edges away from the necessity of existence.

The amelioration of this condition has engaged the attention of sportsmen for years. In isolated cases some good has been done, though the tendency has been a reaction which at best must be termed provincial.

The Eisner National Rod and Gun club plan appeals to me as being the soundest method of solving the sportsmen's dilemma. The objectives of the Eisner plan are to first, last and all the time recognize the farmer's rights as a sportsman and landowner; to seek the cooperation of the farmer by cooperating with him to protect his property; to assist him in securing game for propagation and see that in some manner he is reimbursed for the trouble; to share with the farmer the burden as well as the pleasure of hunting and fishing; to truly balance the administrative authority and manipulation of rod and gun club affairs by having in the directorate an equal number of farmers and city sportsmen; to work with the farmer to the end of securing such legislation as will work to his best interests and those of the majority; to encourage a spirit and morale of better sportsmanship, a closer observance of the game laws, to foster the effort to reduce hunting accidents; to emphasize a true regard for wild animal life and the necessity of game conservation.

These are the basic principles of the Eisner plan which starts at the beginning, right where it should, and this is the local unit of organization. The local club shall have as its officers a president, a vice president, secretary and treasurer and eleven directors, which shall be composed of five farmers, five city sportsmen and the deputy game warden. Membership is open to every farmer in the county and to all sportsmen who have been able to secure hunting licenses, and over these the club will eventually exercise control.

Each member is given a numbered card and at certain periods the farmer members receive bulletins giving the names, addresses and number of those belonging to the organization. The hunting grounds are posted with trespass signs issued under the seal of the national organization and none but members are permitted to enter these grounds and then only after announcing his name and number to the landowner, who shall hold the hunter responsible for any damage done to the property on the day so occupied.

Should a complaint be lodged against any member for damage or the violation of the game laws, the offending member is summoned to appear before the directors and the deputy game warden will act as chairman for the hearing. The number of clubs in any county shall be restricted; each club, however, takes its name from the city, town, or village in which it is organized. From each club in the county is selected two members, one a farmer and the other a city sportsman who do not hold office in the local organization. These two men will represent their unit by acting as directors of the state organization, composed of all the clubs in that state.

The principal other officer of the state organization will be a secretary and his office shall be located at the state capital, where he may keep in touch with the legislators and be in a position to promote such legislation as the membership body may deem necessary. The state associations in turn will form the National Federation of Rod and Gun Clubs of America, the main officers of which will be two directors from each state, one a farmer and one a city sportsman, with the national secretary maintaining an office in Washington, where close cooperation can be given the federal authorities on all matters pertaining to hunting and fishing.

The policies outlined can be broadened in scope and should be, to include reforestation problems and the dissemination of valuable educational information along with the repopulation of waste land with wild animal life. These are the problems that the national organization could and would take hold of with a giant's grip. This done we arrive at the solution of how to "Hunt Posted Property."

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AUGUST 1, 1922.

"Bag limits are crude and subject to great variability. If you halve the bag limit and triple the number of hunters in a given decade, you are still drawing on your principal, whereas the number of game refuges and consequently the breeding stock can be steadily increased in proportion to the demand for game."—(Bulletin Amer. Game Prot. Assoc., Oct., 1921.)

UNITED STATES FOREST SERVICE REPORT ON GAME CONDITIONS.

An agreement between the United States Forest Service and the California Fish and Game Commission, entered into in 1920, provides that the Forest Service shall report annually to the Commission game conditions within the national forests of the state. This report for 1921 contains a mass of valuable data relative to fish and game. The more important recommendations of forest officers include additional game refuges and enlargement of several of those already established; reduction of the bag limit on deer; the need of more reliable information on the number of deer in each particular locality, and particularly the number of bucks killed annually; and the need for additional game wardens to improve law enforcement.

The report shows that sage hens have been so reduced in Mono and Inyo counties that a closed season is recommended. Tree squirrels in southern California are becoming so rare that a closed season for a term of years is becoming almost a necessity. The toll taken of mule deer in Lassen and Modoc counties threatens the extinction of this species and better protection must be given it if a sufficient breeding stock is to be maintained. As in past years, the report on grouse is rather discouraging. This bird, although seldom hunted, is hardly holding it own through most of the mountain districts. Encouraging reports are made on the increase of the few bands of elk to be found within the national forests and the report on mountain sheep and antelope is also encouraging.

Tables give an estimate of the number of big game animals within the national forests of the state. The estimated total of deer is given as 184,785, and the reported kill for 1921 within the forests as 7,067. The estimated number of elk is 79; that of mountain sheep is 775, the latter being a very pleasing total.

Another table shows that forest officers, during the calendar year of 1921, prosecuted 66 cases for violation of fish and game laws, the fines amounting to $2,745.

GAME REFUGES POPULAR.

Judging by the increased demand for new refuges and for an extension of the boundaries of those already established, it is quite evident that in the eyes of the public the game refuge is popular and has justified its place as a conservation measure.

Where deer concentrate in certain areas during the hunting season a large toll is taken by hunters. There is no more satisfactory means of reducing this toll than to set aside an area as a game refuge and such a recommendation usually follows. This would at first appear to make deer harder to find and hunting more difficult. As it works out, however, the safety of the breeding stock within the area causes an increase which spreads out to the surrounding territory, furnishing better hunting. Many deer hunters are ready to testify that hunting has improved in the areas near the big game refuges.

There is a tendency, due to the popularity of the refuges, to demand the setting aside of numerous large areas. Should the demand continue, there is danger of usurping too much of the hunting ground and causing a reaction and change in sentiment that would perhaps destroy many of the refuges now in existence. It would seem best to proceed cautiously and to select with care a few out of the many recommendations for new refuges.

THE HUNTER AND THE LANDOWNER.

Oftentimes, from the standpoint of the landowner, the hunter is no respecter of property, and consequently is not to be tolerated. "Why must I raise deer and quail for these city sports that come out hunting on my land, breaking down my fences, leaving my gates open, and carelessly killing my livestock?" is the usual plaint. That there is some justification for this viewpoint must be admitted. In recent years, hunters are finding the law of trespass more closely enforced and they are coming to their senses with the result that the hunters themselves in many parts of the country are carrying on an educational campaign to make the farmers rights better respected. In some instances, rod and gun clubs and fish and game protective associations have gone so far as to put up signs offering rewards for information leading to the arrest and conviction of anyone damaging the property of another while in the pursuit of game. Adherence to such rules as the following are advocated:

1. Respect the rights of the owner of this property; he is a good fellow or it would be posted.
2. Make good any damage you do, and report that done by others. You may want to come again.
3. Don't throw away a lighted match, cigar or cigarette. Aid in fire prevention.
4. Obey and assist in enforcement of fish and game laws of the commonwealth. Notify nearest game warden of violations.
5. There are two kinds of sportsmen: the regular guy and the piker. Where do you fit? It is a decided compliment to be known in your community as a clean sportsman.

Certain it is that the future privileges to the man who hunts or fishes depend upon the actions of the men who take the field today. In some way there must be worked out a closer cooperation between the landowner and the man who hunts if wide open fishing and hunting is to continue, and the usual "get out" of the landowner becomes an obsolete expression.

STRIPED BASS SCARCE IN NEW YORK.

The editor of the fishing and hunting section of the "New York Evening Mail" points out that the 1920 season's catch of striped bass for the State of New York was only 24,437 pounds. The catch in California during the same period amounted to 671,731 pounds.

The original stock of striped bass used for introducing this fish into California waters came from the neighboring state of New Jersey. The first introduction was made in 1879 with fish from the Neversink River, and a second introduction was made in 1882 from fish taken in the Shrewsbury River. From a state with no striped bass, California has come to be a state with a much better supply than that to be found at present in eastern states from which our original supply was taken.

Doubtless protective measures are largely responsible for the continued supply of this splendid food and game fish. As early as 1889 it was feared that the recently introduced striped bass were being exterminated before they had come to maturity and had a chance to reproduce. A county ordinance in San Francisco was accordingly passed, prohibiting the sale of striped bass under eight pounds in weight. Laws now provide against the shipment of striped bass out of the state; prohibit the sale or shipment of striped bass less than three pounds in weight; the sale of striped bass of over ten pounds in weight between April 1 and May 31; the sale of striped bass of any size between June 1 and July 31, or between September 17 and November 14; the taking or having in possession at any time of any striped bass of less than twelve inches in length; the taking within District 2 of more than five striped bass per day; the taking of striped bass between one hour after sunset or one hour before sunrise, or in nets on Saturday and Sunday, and the use of nets with a mesh smaller than five and one-half inches. Besides this, fully 1000 miles of sloughs in the San Francisco Bay region have been closed to commercial striped bass fishing. As a concession to the angler, a person may have in his possession, in any one calendar day, not to exceed five striped bass, between twelve inches in length and three pounds in weight; but such striped bass must be caught only with hook and line and must not be bought, sold or offered for sale.

It can be seen, therefore, that careful protection has been given striped bass in California, in fact, greater protection than has been afforded in eastern states. Protection of spawning fish, closed seasons, size limit and limited sale, all contribute to the safeguarding of this valuable fish.

POND FISH FURNISH MANY EGGS.

A splendid system of breeding ponds has been maintained for many years at the Mount Shasta Hatchery. A fine supply of trout eggs is annually obtained from these brood fish. This season a total of 8,000,000 eggs was secured. The importance of this steady supply is apparent during such seasons as the past winter when spawning operations have been made very difficult by the heavy snows and the high water. In many instances the water has continued to overflow the racks, and in some cases the racks have been completely washed out, so that they had to be replaced. Such difficulties, combined with that of deep snow, makes spawn taking uncertain.

It is quite apparent that if the pond systems of our hatcheries could be tripled, a dependable supply would be assured, despite adverse weather conditions.

COUNTY USE OF LICENSE FEES.

Almost every sportsmen's organization formed in the state comes to the decision that its particular county is being unfairly treated and that it is not receiving patrol and fish for planting equivalent to the number of license fees paid into the preservation fund from that particular county.

Patrol and fish distribution is allotted as equitably as is possible. If fish and patrol service were distributed according to license fees, the counties with the larger cities would use practically all of the funds, and certain counties, where people spend their vacations, would receive no fish for planting and no patrol service. Alpine county, for instance, has a population of a few hundred, whereas residents of other counties annually use the fish and game resources. Certainly it is apparent that the present system is far more dependable than any distribution of fish according to counties.

GRAZING ENDANGERS GAME REFUGES.

A visit to many of the state game refuges will show that game is not receiving adequate protection, due to the destruction of food supply by cattle and sheep. Food supply is one of the most important factors concerned in the welfare of any species and the grazing of cattle and sheep in the refuge means a lessened food supply for game. Those conversant with conditions maintain that the disappearance of grouse in the higher mountains is due largely to the pasturing of sheep. Sheep are taken to the high mountain meadows at just the time when the grouse are nesting and the nests are trampled out and the grass cropped so clean that even a food supply for these birds is largely destroyed. Recent reports from Game Refuge 1D in Trinity County indicate that so many cattle are allowed to feed within this refuge that browse has become very scarce for deer. Any area will support only the number of big game animals for which there is an adequate food supply. A diminished food supply means a diminished number of deer.

Unless more attention is paid to the improvement of grazing inside game refuges, these areas will not be performing the service for which they were set aside. Undoubtedly cattle men and sheep men will oppose any restriction of grazing but there should be sufficient public sentiment to successfully close to grazing at least portions of each game refuge.

CRAPPIE FISHING IMPROVES NEAR SACRAMENTO.

The crappie appears to be taking the place of the Sacramento perch near Sacramento. This species seems to become more abundant from year to year, and every week-end and holiday sees hundreds of men and boys angling for this splendid game fish.

The crappie takes the fly readily and is easily caught on a spinner. Anglers maintain that the crappie compares favorably with the black bass as a pan fish.

THE UNAPPRECIATED SHAD.

The market for shad continues so poor that fishermen are tempted to throw back into the water all of the buck shad secured in their nets. Fishermen have been receiving but two cents per pound for buck shad and it retails for about six cents. Roe shad have a somewhat greater demand, but after the roe has been taken from the fish, it has but small value. In eastern cities the public is glad to pay 90 cents a pound for buck shad and anywhere from $1.25 to $1.50 for roe shad. Here in California at the height of the season one is able to obtain a good three-pound fish for about 25 cents, and yet there is no sale for it. Planked shad does not have the attraction for the Californian that is has for the Easterner. The person who can make shad popular in California can make his fortune. Someone ought to try placing filet of shad on the market to see if this would be more attractive than the fish in the round.

SEVERE WINTER HINDERS FISH-CULTURAL OPERATIONS.

The accompanying photographs from the Tahoe region should carry conviction that the fishcultural department encounters increased difficulties during severe winters. Most of our trout spawn very early in the spring and in the highest parts of the mountains. Access to such

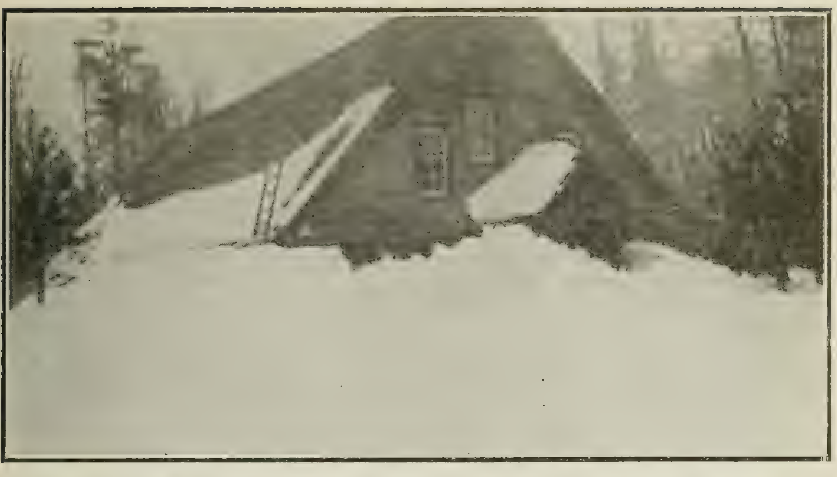

FIG. 75. Mt. Tallac Hatchery, April 1, 1922, when spawning operations began in the Tallac region. Photograph by Jos. Sanders.

localities during February and March is often very difficult and yet the spawn-takers must reach the spawning stations before the run of fish is over. This often necessitates covering many miles on snowshoes, and living and working for many weeks in situations comparable to the arctic regions. Often before the streams have been cleared of ice it is necessary to build racks and traps. The actual spawning of the fish must usually be accomplished with snow many feet in depth.

A successful take of eggs is dependent upon a group of men who forego many bodily comforts in order to reach the spawning grounds in time, and great credit is due these loyal workers.

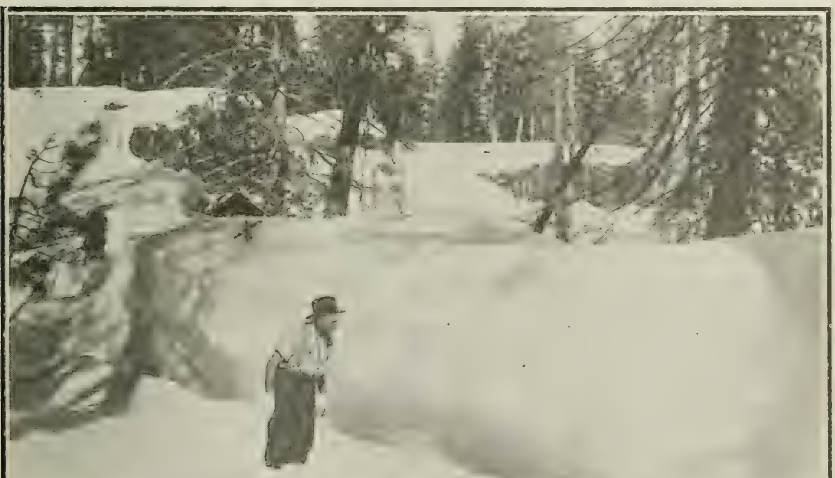

FIG. 76. Domingo Springs Hatchery, as it appeared on the arrival of spawn. Taken on April 2, 1922. Cross marks roof of hatchery Photograph by J. W. Ricker.

PREDATORY ANIMALS DESTROYED.

"The latest report filed by Inspector Chas. G. Poole, in charge of the cooperative predatory animal service, conducted jointly by the Federal Bureau of Biological Survey and the California State Department of Agriculture, shows a grand total of 1447 animals taken during the nine-months period July 1, 1921, to April 30, 1922. The detailed list shows 1008 coyotes, 277 bobcats, 64 skunks, 41 raccoons, 37 foxes, 18 badgers and one bear. Signed statements of stockmen and farmers show an average decrease in losses of live stock and poultry amounting to 88½ per cent. It is estimated that only one out of every three poisoned coyotes is found, which would materially increase the foregoing figures."

To the sportsman taught to believe that predatory mammals have a very direct bearing on the abundance of game, this report should be very pleasing. To the conservationist who would save nature as near unspoiled as possible, such a report is disturbing. To the biologist interested in the interrelations of living animals, such a report emphasizes that difficult problem presented by man's interference in the "balance of nature" and the consequent disturbances which entail endless artificial control measures.

DEER REPORTED DYING IN SEVERAL SECTIONS OF STATE.

It is not unusual for reports of dead deer to come in from the coast range mountains from Sonoma County northward. A number of deer appear to die each year in this section of the state even when there is no evidence of such an epidemic as appeared in Trinity County a number of years ago. This spring, reports have come from such widely separated places as the Mount Hamilton region in Santa Clara County, and parts of Siskiyou County, that deer were dying in considerable numbers. The report from the Mount Hamilton district, made by Dr. W. H. Wright of the Lick Observatory, states that the deer appear mangey, with large white patches on the sides.

HEARINGS HELD ON USE OF FOOD FISH IN REDUCTION PLANTS.

During the week beginning April 10, hearings were held in San Pedro relative to a violation of the law which provides that canneries may use not more than 25 per cent of the monthly catch in reduction plants. At the last session of the legislature, legislation was provided designed to prevent the use of food fish for the manufacture of fish oil and fish meal. In recent years each cannery has erected reduction plants in order to utilize the waste from the plant. As there was a tendency because of the demand for fish meal and fish oil, to utilize many sardines and other fish suitable for food, it seemed best to legislate against such a practice. The law prohibits the use of food fish in reduction plants, but provides that after a hearing permission may be obtained from the Fish and Game Commission to make use of unavoidable excess catches when no other market is available, the amount so used, however, in no case to exceed 25 per cent of the catch for the month. On January 11, 1922, the Fish and Game Commission issued an order stipulating that the catching of fish for use in a reduction plant would not be tolerated. During the past few months several canneries in southern California have failed to stay within the law and have apparently been evading the law and the regulations issued. As a consequence a complaint was filed and hearings have been held. The hearings have clearly shown that these canneries violated the law during the month of February. The penalty provided by law is a suspension of the license to operate for a period not to exceed 90 days. As the sardine season is over and will not be resumed for several months, and as each of the canneries will begin the canning of albacore and tuna in June or July, it has been decided to impose the maximum penalty in order that it may mean something. A suspension of the license for 90 days will keep some of the canneries closed during the early part of the albacore season.

VIOLATORS HEAVILY FINED.

A. Russo and five Italian fishermen were arrested by Deputy Burke at Visitacion Valley on three charges: (1) Fishing in District 3; (2) Using an illegal net; (3) Possession of striped bass. The case was tried before Judge Griffin of Redwood City on April 6, and Mr. Russo, who is an old violator, was fined $250 on the first charge and given 100 days in jail. Four of the other fishermen were fined $100 each, making a total of $650 in fines. The fifth fisherman, who was an old man of sixty-nine years, was dismissed.

THE RURALIST'S ATTITUDE ON HUNTING.

Everyone who talks to residents in the less settled portions of the state soon finds that their attitude on game laws is quite different from that held by the city dweller. The point usually made is that since the owner of the land provides food and shelter for game, the landowner should have a right to utilize it for food. The point is always made that the city sportsman comes out into the country and kills his limit of deer, all of which he is not able to use, and consequently, almost invariably leaves venison to spoil in the woods. On the other hand, the resident of the hunting section maintains that he takes a deer when it is needed for food and utilizes the whole animal. Anyone who studies this situation must in fairness agree that the rural resident really has foundation for his attitude. Had city sportsmen properly conducted themselves, this point of view would have much less foundation, for, in America, game does not belong to the owner of the land but to all the citizens of the commonwealth.

THE GAME OF THE SMALL BOY.

Small game is not altogether the quarry of the boy hunter. Many men turn their attention to small game when unable to take the journey necessary to reach big game. Probably several times more rabbits are killed in California than all the big game put together. Originally the stock of rabbits was so great that it seemed almost impossible that the hunter could make any impression on their numbers. At the present time we find interest sufficient to support a closed season throughout the state, in spite of the oft-repeated accusation that rabbits are destructive to growing crops. In southern California, where rabbits cause more damage, sentiment is not so favorable to the closed season.

One state in the Union, having used up its supply of rabbits, has been paying thousands of dollars to secure specimens for restocking. Whether California will ever find herself in a similar situation we can not say, but now is the time to look to the future and see that a sufficient breeding stock is saved annually to provide food and sport for the small boy and the local sportsman. The comparative abundance of small game is likely to lead sportsmen to center attention on big game and forget the needs of the quarry of the boy hunter and the farmer.

"MACHINE GUNS VERSUS SEA LIONS."

A paragraph with the above heading appeared in a recent number of the Fish Trades Gazette (Organ of the National Sea Fisheries Protective Association, London) as follows: "The Canadian Department of Fisheries intends to wage an active campaign this summer against the hair seal and the sea lion—the principal enemies of the salmon, says the "Times Trade Supplement." The seals will be attacked in their rookeries off the Queen Charlotte Islands and the west coast of Vancouver Island. Machine guns and rifles will be used, the main effort being to exterminate the young of the sea lions. In past years hair seals have done great damage among the salmon. At one time bounties were offered for them, but of late years this practice has been discontinued."

The economy of thinning out or exterminating the seals and sea lions on the Canadian coast need not here be discussed, for surely the responsibility for such action would not lightly be taken without a thorough inquiry and analysis of conditions. If the sea lions have increased until they are a menace to the fisheries, a reduction may well be undertaken, but the reduction should be under complete and exact control.

The method proposed may be open to considerable criticism. It seems wasteful, unnecessarily cruel, to lack control, and especially to be without provision for knowing exactly the number of sea lions killed each year.

Machine gun fire into a mass of sea lions can not help but result in wounding many of them, leaving them to suffer A shot sea lion will use its last strength in plunging into the sea where it at once sinks. Unless shot through the brain, spinal cord or heart it will have life enough to do this, and many will be wounded in parts that are essential to life but may not lead to fatal results for several days. The interval can not be contemplated with any pleasure.

Each female killed before its young can find food for itself will mean the slow starvation of the young. On the California coast the sea lion nurses its young nearly up to the time the next young is born. In Alaska the nursing season is apparently shorter. Just at what age the young could shift for itself is not known. Probably it could obtain solid food within a few months of its birth, but surely not at a time when it is still on the rookery in numbers, which would be the most profitable time for machine-gun fire. To be sure, there is a time in the breeding season, when the young are a few weeks old, that the adults may be driven from the rookery, and the young only may then be the recipients of the rain of bullets, but there are surer, more merciful methods than such a hit-or-miss one, if the rookery can be landed upon. The death of each female means the starvation of its young, because by no possibility will a female allow any but its own young to nurse.

The method is wasteful because the skins may be made of commercial use, if a number can be obtained at one time, or if the supply is at all regular. The coast would doubtless yield several hundred skins each year.

Numbers among the sea lions can be easily and exactly controlled by the death of the young. Firearms of any kind are not necessary. The young do not leave the rookery until they are 5 to 6 weeks old, and a man with a club could land on a rookery and kill 500 in a day. This method would be humane, and doubtless would be at least profitable enough to make the sea lion controlling body self-supporting. By such a method a definite number could be killed each year and the result watched that there may be no danger of complete extermination.

Of course some rookeries could not be landed upon at any time, and that is probably the reason for the suggested machine-gun method of control.

That this method would be efficient is well shown by the black, or California, sea lion the young of which was hunted by sealers on the rookeries so that within a short time that species was so reduced in numbers that extermination was feared. It is now protected on the Santa Barbara Islands, where it breeds.

Mr. C. H. Townsend wrote a paper on "The Utilization of the Sea Lion (Zool. Soc. Bull., Mar., 1919), in which he advocates the killing of the young, as is done in the Newfoundland seal fishery. If some of our California rookeries continue to increase in size (as the Ano Nuevo Island rookery apparently is doing), especially if it can be shown that the increase is not just local, but of the entire coast, this herd may have to be kept within a reasonable size by some such method as that here considered.—EDWIN C. STARKS, Stanford University, California.

THE COST OF LAW ENFORCEMENT.

According to statistics compiled by the Indiana Department of Conservation: the cost to the State of New York for each of the 4090 convictions last year amounted to $79.57. The State of Missouri, with about one-sixth the number of salaried wardens, paid $671.04 for each conviction. The later amount even exceeds the cost in western states, where vast areas of big game country must be patrolled by a single man, and convictions are necessarily few and far between.

PRINCIPLES OF MANAGEMENT.

"In order properly to manage our wild life resources, particularly the fish and game, certain definite action is necessary. Protective measures, as well as methods to increase the production of fish and game, must be based on correct information regarding natural history. The public and particularly the sportsmen, must appreciate the reasons for such measures and provide a public sentiment that will demand their being carried out. The administration of the game department must be such as will sincerely strive to improve conditions and have the interests of the sportsman at heart.

"In this connection let me emphasize the necessity for the wild life enthusiast and the naturalist to recognize the great number of men who are just ordinary sportsmen. Working by himself the naturalist plays rather a lone hand but by active cooperation with the sportsmen he can give them much information they are anxious to obtain and can do considerable in encouraging better sportsmanship. In the end it is the attitude of the average man which governs the success of protective measures and it is through him that the greatest results can be obtained."—S. B. LOCKE, Ogden, Utah.

HANDSOME GIFT FOR WILD LIFE PROTECTION.

The National Association of Audubon Societies has just received a cash donation of $200,000, the largest of numerous donations which through the years have been received from the same source. All the gifts of this friend of wild life have been made with the distinct understanding that the name of the donor be withheld. The recent check is to be known as the "Permanent Fund of 1922" and the interest is to be used along the lines of endeavor specified by the giver, which are as follows:

1. For the education of the general public in the knowledge and value of useful, beautiful and interesting forms of wild life, especially birds.
2. For the actual protection and perpetuation of such forms of wild life on suitable breeding and other reservations.
3. For protecting and maintaining adequate protection for such forms of wild life in all parts of the Western Hemisphere.
4. Or for any one of these purposes.

TWO GAME REFUGES RECOMMENDED FOR PLUMAS NATIONAL FOREST.

It has been roughly estimated by the Forest Service that there were approximately twenty-five thousand deer ranging in the Plumas National Forest in 1921. However, it has also been estimated that more deer were taken from Deer Creek Meadows and Dixie Valley in 1921 than in all the rest of the National Forest, showing that deer concentrate there each fall. It is now being strongly recommended that two new game refuges be established, one in the vicinity of Dixie Mountain, the summer range for the mule-tailed deer, and the other in the Deer Creek Meadows. The elimination of hunters from these areas would greatly reduce the annual toll. These refuges would also greatly benefit quail and grouse, since sheep would be excluded. Grazing sheep constitute one of the greatest menaces to nesting quail and grouse.—George W. Chamberlin, Quincy, California.

GAME AS A NATIONAL RESOURCE.

The United States Department of Agriculture has rently issued a bulletin (No. 1049) by Dr. T. S. Palmer, expert in game conservation, on the subject of "Game as a National Resource." This bulletin discusses briefly the value of game as food and as an asset to the individual and to the state, reviews the various methods by which estimates of such values are obtained, and points out some of the causes of present depleted conditions and some of the methods by which game resources may be preserved and increased, together with the expense involved in work of this kind.

A few of the outstanding facts gleaned from this publication follow:

"Of the 19 states north of latitude 42 degrees and Mason and Dixon's line, 16 had deer hunting in 1920, the exceptions being Connecticut, Rhode Island and North Dakota. Of the 29 states south of this line, Delaware, Maryland, West Virginia and nine states in the corn belt had no deer hunting and Missouri had very little. The possible deer crop is more than twice as large in the northern tier as in the southern, the possible kill under normal conditions being respectively 60,000 as compared to 25,000. The only states to the south where the annual kill is likely to exceed 5000 are California and Texas.

"In a number of states serious inroads have been made in the breeding stock because until recently laws have permitted the killing of does. In New York in 1919, when the season was open on both bucks and does, probably more than one-third of the total number of deer in the state were killed.

"Elk formerly occurred and were hunted in nearly every state. Estimates made a few years ago showed a total of approximately 72,000 elk in the United States, whereas today it is doubtful if the number is much in excess of 52,000, of which about 25,000 are found in the Yellowstone National Park and adjoining regions. Elk hunting has been closed in most states and is now restricted to a few counties in Idaho, Montana and Wyoming, where the number is limited to one to each hunter.

"Rabbits probably constitute the largest, cheapest and most generally available supply of game in the United States. Abundant almost everywhere, shot for sport and market, and free from non-sale restrictions in many states, they form an important item of food supply. The jack rabbits in the West, which are a serious pest in some states, are destroyed in enormous numbers, but only a relatively small number are placed on the market and find their way to eastern states. Cottontails, however, are found in every state in the Union and during the autumn and winter are hunted almost everywhere. In 23 states there are close seasons and other regulations, but in the other states there is at present no restriction on hunting. These animals form a nutritious and relatively cheap meat, which is thus available to a considerable number of persons who can ill afford to pay high prices for beef, mutton and pork.

"Every state has some species of quail, either native or introduced. Probably no game except ducks is more generally hunted. The sale of native quail is now prohibited throughout the United States except in a few counties of North Carolina.

"The hunting license fees now required in most of the states constitute a comparatively modern source of income, dating back only to 1895.

"Of the various methods of increasing game resources which have been suggested or put into practice in the United States, four merit special notice, namely, protecting game, establishing refuges, restocking depleted areas, and breeding on game farms.

"Artificial game propagation is still in an experimental stage, and the kinds of birds which can be produced in large numbers with any degree of certainty are at present very limited.

"In regulating seasons, certain principles are generally considered fundamentally important. Among these are the prohibition of summer shooting—that is, during the breeding season; the prohibition of spring shooting, while birds are on their way to the breeding grounds; and the protection of females of big game, particularly in the case of deer.

"The states which have the largest aggregate areas devoted to game refuges are California, Minnesota, and Wyoming; those which have the greatest number of individual refuges are probably Michigan and Pennsylvania.

"Two elements are essential for the success of any game refuge: First, permanency; and, second, sufficient area in a compact body. For the protection of big game, long narrow strips of territory are comparatively worthless and constantly shifting boundaries furnish little actual protection.

"No field of conservation is more important than the restoration of game in regions where it has been reduced to the vanishing point or completely exterminated. Plans for bringing back the game usually involve legislation, introduction, or propagation.

"The principal expense connected with the protection of game is the maintenance of a patrol adequate to prevent violations of the laws.

"Estimating the total amount of each kind of game in any state would make it possible, by revising and comparing the estimates from year to year, to tell whether the stock is increasing or whether the total number killed exceeds the annual increase."

That enumerations and valuations of the annual kill of game are not as yet stabilized is evidenced by the wide divergence of the valuation placed upon the various kinds of game. In the tables given, New York placed a valuation of $75.00 on each deer, whereas Virginia estimates the value of each deer at $26.00. It is to be hoped that some more uniform valuation may be determined upon in the near future.

CONSERVATION IN OTHER STATES.

MISSISSIPPI PLANS GAME LAWS.

Mississippi is one of the few remaining states that has no game laws or any organization to protect fish or game. The first sign of awakening is now at hand, however, for the Mississippi State Game and Fish Development League was recently organized at Vicksburg. This organization is backing attempted legislation in the Mississippi legislature.

LANDLOCKED SALMON PLANTED IN IDAHO.

The state of Idaho last year planted eastern landlocked salmon under ideal circumstances and plans to continue the introduction of this species during the next two seasons.

CONSERVATION IN MEXICO.

For some time it has been advocated that the United States Government enter into a treaty with Mexico for better protection of such of our migratory birds as winter in that country. Fortunately the Mexican Government is now showing an interest in the protection of wild life, and as a result that country is planning the passage and enforcement of the first game laws to be enacted in Mexico. In furtherance of this plan the Mexican Department of the Interior recently sent Mr. Delfino P. Cedro to the United States to study our methods of conservation, our laws and their enforcement.

UNITED STATES FOREST SERVICE COOPERATION.

PAUL G. REDDINGTON, Editor.

ELK INCREASE ON CLEVELAND NATIONAL FOREST.

One calf elk was reported in the band of 12 liberated in the Laguna Mountains in 1919. Seven of these elk located near the Laguna Recreation Area and are apparently in good condition. The other five drifted to the lower elevations along the desert slopes and not much is known as to their present number or condition.

GAME CONDITIONS ON THE ANGELES NATIONAL FOREST.

It is estimated that about 160 mountain sheep within the forest are principally in the San Antone and Twin Peaks country in refuges 4A and 4B. On the Forest outside of the refuges very little hunting is done as the deer immediately go into the refuges soon after the opening of the hunting season. Even in the refuges deer are not as plentiful as they should be considering the length of time they have been protected. Deer are found in greater numbers around the more frequented locations than in the more remote portions of the refuge. This is attributed to mountain lions being more plentiful in the less frequented areas. It is also reported that the mountain sheep have not increased to any extent in the past seven years on account of mountain lions and the work of poachers. Several sheep carcasses partly devoured have been found.

A FEW ANTELOPE LEFT IN SOUTHERN CALIFORNIA.

Antelope may still be found along the foothills of the Tehachapi Range and in Antelope Valley on the Santa Barbara Forest where there are at least 10.

INTRODUCED ELK THRIVE ON SEQUOIA NATIONAL FOREST.

A few elk are reported on the Sequoia Forest. It is believed they drifted from the Sequoia National Park. There were some Buttonwillow elk placed in the Kaweah country several years ago. A stockman reported seeing two yearling elk last summer, which indicates the herd is increasing.

MOUNTAIN SHEEP ON THE INYO NATIONAL FOREST.

It is estimated there is a total of 365 mountain sheep on the Inyo Forest. They are found principally on Wyman Creek, Waucobe Canyon and Piute Mountain, Goldale and Birch Mountains, Pine and Rock Creeks. They seem to be slowly increasing through the protection afforded by a closed season and a close compliance with the game laws.

GAME INTRODUCED ON THE MONO NATIONAL FOREST.

Carson Valley sportsmen are taking an active interest in game propagation and protection and have introduced ring-necked pheasants, bobwhite and Gambel's quail. The ranchers in this locality take especial care in feeding these birds during heavy snow.

MANY DEER KILLED ON LASSEN NATIONAL FOREST.

It is believed about 5000 hunters visited he Lassen Forest the past hunting season, and that 450 deer were killed. The mule-tail deer on this Forest are reported as rapidly decreasing. During the war period there were relatively few hunters and this species of deer rapidly increased. However, with the tremendous increase in the number of hunters since the war, it is believed this species of deer is in danger of extinction.

MULE DEER IN DANGER OF EXTERMINATION.

The Columbian blacktail and the mule deer are both found on the Shasta National Forest. It is estimated that there are 12,000 of the former and 1000 of the latter, or a total of 13,000. The mule deer are largely found in the northeastern part of the Forest within and adjacent to the lava bed country. It is estimated that a total of 427 deer were killed by hunters during the past season, of which 134 were mule deer. This is an increase of over 43 per cent over last year in the number killed of this species, there being only 76 killed during the season of 1920. There was a large increase in the number of hunters in the mule deer country last year.

ELK ON THE SHASTA NATIONAL FOREST.

Several years ago the Elk Lodge at Redding shipped 50 elk from the Yellowstone Park and placed them on this Forest. About half the number died soon after they were liberated. The remainder have increased up to about 60 head and are now located on Brock, Lick and Flat creeks and on Brock Mountain. Last year several calves were seen. It is believed this herd has now become permanently established and will continue to increase in numbers.

MODOC COUNTY PAYS BOUNTY ON COYOTES.

Last year Modoc County paid bounty on almost a thousand coyotes, many others being killed upon which the bounty was not collected. While coyotes prey chiefly upon domestic stock in this locality, it is known that they kill a great many deer on the Modoc National Forest.

ELK ON THE KLAMATH NATIONAL FOREST.

There is a band of seven elk on the Scott River District of the Klamath Forest. While this is only an increase of two over the number reported last year, it is believed these elk are now doing well and will increase in numbers more rapidly in future years.

TRINITY COUNTY PAYS BOUNTY ON COYOTES.

During the past few months local hunters with dogs have killed 10 mountain lions in and around game refuge 1D situated within the Trinity National Forest. Trinity County has been paying a $3 bounty on coyotes for the past several years and from 1908 to 1921, inclusive, has paid out a total of $11,992 in bounties.

CALIFORNIA FOREST HAS BIGGEST RECORD OF DEER KILLED.

During the hunting season of 1920 a record of 1200 bucks killed by hunters was obtained by Forest officers of the California National Forest. It is safe to assume that this does not cover half of the deer killed, which would probably total 3000. The great majority of bucks taken are forked horns, and it is a common statement by hunters that larger bucks are much scarcer than formerly. This is in all likelihood due to the great increase in hunting, for during the last ten years the number of visitors to this Forest has easily increased six times, and is conservatively estimated at 6000 for the season of 1921. Three-fourths of this number visited that portion of the Forest included within Game District 2, which has the early opening date of August 1.

VIOLATIONS OF FISH AND GAME LAWS,

January 1, 1922, to March 31, 1922.

Offense	Number of arrests	Fines imposed
GAME.		
Hunting without a license	12	$165 00
Hunting in game refuges	2	20 00
Hunting in posted grounds	2	20 00
Night hunting	1	25 00
Trapping without a license	3	30 00
Making false statement to secure hunting license	1	40 00
Birds, non-game; possession, killing	4	170 00
Deer, possession, killing, closed season	7	195 00
Does, possession and killing	6	300 00
Deer meat, possession, closed season	12	360 00
Ducks, possession, killing, shipping, closed season, over-limit	14	400 00
Gallinule, possession and killing	1	25 00
Geese, closed season, over-limit	3	50 00
Pheasants (wild), killing and possession	4	250 00
Pigeons, possession	1	25 00
Rabbits, possession, killing, without license	6	125 00
Robins, possession and killing	10	121 00
Shore-birds, killing	1	25 00
Squirrels, possession, killing, closed season	4	25 00
Quail, possession, killing, closed season	2	100 00
Shooting before half-hour before sunrise	2	50 00
Shooting after half-hour before sunset	1	25 00
Hides, possession, illegal	5	---------
Total game violations	104	$2,546 00
FISH.		
Fishing without a license	4	$40 00
Fishing in District No. 2	2	---------
Abalones	12	325 00
Barracuda	11	775 00
Bass	5	140 00
Clams	21	630 00
Crabs	9	145 00
Halibut	3	200 00
Lobsters	6	145 00
Salmon	1	100 00
Sturgeon	2	20 00
Trout	12	320 00
Catching young smelt	5	25 00
Spearing steelhead above tide waters	1	100 00
Using net more than six feet in District No. 2	1	---------
Using net more than six feet in District No. 3	1	100 00
Using three-inch mesh net in District No. 12	1	100 00
Using gill net less than 5½-inch mesh for bass	2	100 00
Depositing petroleum in San Francisco Bay	1	200 00
Totals	100	$3,465 00
Grand total fish and game violations	204	$6,011 00

SEIZURES.

Game.

Deer	1
Deer head	1
Deer meat	105¼ pounds
Ducks	1,113
Elk	50 pounds
Fawn	1
Geese	64
Grouse	2
Killdeer	4
Meadow lark	1
Prairie chickens	2
Quail	38
Rabbits	16
Robins	14
Squirrel	1
Wild pheasants	4
Skins	9

Fish.

Abalone	139
Abalone	612 pounds
Abalone	90 boxes
Bass	60
Striped bass	119
Striped bass	70 pounds
Striped bass	1 box
Barracuda	124
Barracuda	8,169 pounds
Clams	543
Crabs	1,465
Lobsters	120
Lobsters	50 pounds
Lobsters	88 boxes
Halibut	1,825 pounds
Salmon	3
Salmon	90 pounds
Shad	1
Smelt	479 pounds
Sturgeon	11 pounds
Trout	5
Steelhead trout	219 pounds
Steelhead trout	4 boxes
Illegal net	3
Searches	15

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JANUARY, FEBRUARY AND MARCH, 1922.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Glenn, Tehama, Colusa	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	Imperial	San Diego	Total	Mexican, brought into California
Albacore																	
Anchovies												60,246				60,246	
Barracuda											24,080	490,078	145		191,632	705,935	780,065
Bluefish									113	13,772						13,885	
Boccaccio								32,750	99,828	316,705	980					450,263	
Bonito												20,905			9,486	30,391	23,916
Carp		1,700		1,488		5,016	11,220	38								19,462	
Catfish		60,895				674										61,569	
Chilipepper								11,972	92,391	11,274						115 637	
Cultus Cod	2,332	296						99,676	5,515	24,393		5			192	132,409	
Dolphin																	
Eels																	
Flounders	12,801		25	192			380	127,957	11,316	705	191	100			120	153,787	120
Grayfish							50	51,592							68,940	120,582	
Greenfish																	
Hake								1,475								1,475	
Halibut								13,694	434	3,708	120,708	612,955	38,021		160,462	949,982	104,246
Hardhead						9,539	70,345									79,884	
Herring	5,937		170					206,446			517					213,070	
Kingfish								1,925	29,270	70,336	215	108,542			107	210,395	30
Mackerel										24,096	9,753	424,323	413		78,927	537,512	20,515
Marlin																	
Mullet														774	253	1,027	1,027
Perch	27,853	70	17,320				18	14,779	300	5,422	183	10,636	9		78	76,668	
Pike				58	153	1,196	1,074									2,481	
Pompano								1,350		63		1,047				2,460	
Rock Bass												18,347	932		2,908	22,187	1,896
Rockfish	2,086	1,417						204,827	59,978	159,118	33,357	558,378	880		166,758	1,186,799	20,691
Sablefish								80,893	16,149	1,497						98,539	
Salmon				31,538	38,014	25,444	48,746	223		10						143,975	
Sandabs								313,362	14,250	1,106		2,580				331,298	
Sardines										5,307,965	130	36,172,547			720,239	42,200,881	
Sculpin												13,608			714	14,322	181
Sea Bass—Black												8,446	177		6,573	15,196	6,293
Sea Bass—White	68		820							14	200	149,394	144		74,266	224,906	56,255
Sea Trout	65											277	93		263	698	
Shad				613		2,243	10,904	734								14,494	
Shad—Buck				2,529		2,011	13,445	15								18,000	
Shad—Roe				5,463		1,362	13,467									20,692	

Sheepshead											157	1,130			4,992	6,279	
Skates								41,335	1,850	620	2,505	1,466	874			48,650	
Skipjack																	1,654
Smelt	5,371		2,738				13,356	41,250	246	5,089	22,020	58,155	719		3,323	152,267	
Sole								1,633,593	19,840	11,455	19,595	58,544	1,495		6,328	1,750,850	
Splittail						8,375	7									8,382	
Striped Bass			160	25,020	270	19,686	71,739	7,031								123,906	
Stingaree																	
Suckers						1,100	4									1,104	
Surf Fish																	
Swordfish												105				105	
Tomcod								7,788	1,050							8,838	
Trout—Farm																	
Trout—Steelhead																	
Tuna												625			1,806	2,431	1,991
Tuna—Bluefin																	
Tuna—Yellowfin																	
Turbot			8													8	
Whitebait								386								386	
Whitefish												8,582			495	9,077	2,491
Yellowtail												96,010	760		51,922	148,692	269,092
Miscellaneous	2.482			75			351	7.834	14,196	5.424	35,311	10,633	476			76,782	433
Total fish	58,995	64,378	21,241	66,976	38,437	77,046	255,106	2,902,925	366,726	5.962,772	269,902	38,887,664	45,138	774	1,550,784	50,568,864	1,290.896
Crustaceans:																	
Crabs (doz.)	1,787	161	330				46	11,713	57	2						14,096	
Ecrevisse (doz.)																	
Shrimps			7,179					153,376			20,382					180,937	
Spiny Lobsters												44,426	2,093		50,508	97,027	420,417
Mollusks:																	
Abalones										198,990	960					199,950	6,265
Clams—Cockle	695		4,175													4,870	
Clams—Mixed	8,183		10,548								100	1,093				19,924	
Clams—Pismo									292		37,166					37,458	
Clams—Softshell		1,132	20,160				54,679	13,318								89,289	
Cuttlefish			22					4,147	5,119	21,602		405				31,295	
Limpets																	
Mussels							1,282	3,482	150	2,125						7,039	
Oysters—Eastern (No.)			1,105,511													1,105,511	
Oysters—Native																	
Snails																	
Squid										2,572		12,927			12,607	28,106	
Miscellaneous:																	
Frogs (doz.)																	
Terrapins (doz.)																	
Turtles																	110

All amounts shown in pounds unless otherwise specified. Albacore and Skipjack cleaned. All other fish in round.

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 8 SACRAMENTO, OCTOBER, 1922 Number 4

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FISHIN'.

In Some Lakes Near Mount Lassen, Principally, and Trout, Generally.

By Roy E. Ludlum, Deputy Fish and Game Commissioner.

The district comprising the area of the proposed Lassen National Park has been but little used by the vacationist. Why more people have not taken advantage of trips to this wonderland is possibly explained by its seemingly inaccessibility and lack of publicity. The tourist will find a variety of interests here whether he wishes to hunt, fish, climb mountains, or just camp. This is a summer range of the mule- and black-tail deer; several well stocked lakes as well as the nearby streams will give the angler plenty of opportunity to pit his skill against the trout; numerous mountains in this volcanic region, with their boiling mud springs and ice caves, invite the mountain climber; and camp sites are everywhere.

At present the only automobile roads reaching directly into this proposed National Park are from Chester, Plumas County, to Juniper

Lake, and from Chester to Lee's Camp, Kelley's and Drakesbad, all in Warner Valley, where the tourist may secure meals, lodging and pack outfits for trips to the Mount Lassen district; these accommodations may also be had at Mineral, on the Red Bluff-Chester road.

Going to Juniper Lake, via Chester, by automobile, the tourist will be much impressed with this great body of clear, cold water with its six or seven miles of shore line. With an elevation of 7300 feet, the lake is fed by melting snow and springs, and sloping from its wooded shore it reaches great depths; a single steelhead trout may be seen floating lazily, or a school—sometimes to the number of fifty—may be seen swimming together forty feet under the surface; but going farther out on the lake the bottom is soon lost to view and the depth is left to one's imagination as actual measurements have not been taken.

FIG. 77. Moonlight on Juniper Lake, showing reflection of Mount Harkness. Juniper Lake is famous for its steelhead fishing. Photograph by H. R. Basford.

Juniper Lake was stocked with steelhead trout, in 1915, by the Fish and Game Commission, and the wisdom of this move is best shown by the marvelous development of the fish themselves. Many limits were taken last year, and fine fish they were, weighing up to four pounds. There is a ripple on the water after about 10 o'clock in the morning, but the wind usually dies down before sunset and it is then, as well as in the early morning, that the fly fisherman comes into his own, for the trout come from the depths of the lake to the shallower water in search of the natural insects that fall on the water. A steelhead hooked with light tackle in this clear, cold water will quickly win repute for his wild rushes and spectacular leaps. The supply of these fish in this lake may be greatly increased by successive larger plantings of fry, but all the fish must be introduced as there are no spawning beds; the number of fish that can live in the lake is only limited by the food supply, and it might be possible to supply, with success, animal or plant matter, or both, as food for the trout.

Juniper Lake offers many camp sites and is a center for the auto camper, as several other lakes and many side trips are within hiking distance. It is reported that a hotel will be built this year, and that more boats and pack horses will be available for hire.

Shadow Lake, a short distance from Juniper Lake, is well named and would appeal to the artist as a study in shadows. A pretty picture it is, surrounded by green trees, its surface dotted with lily pads, together with an occasional sunken log, and a constant change of light and shadow over all. But even the "old-timer," absorbed in his surroundings, may receive a decided surprise, if, as he casually casts his first fly, a half dozen eight-inch rainbow trout rush at his artificial bug bent on its destruction! This lake is small, and like Juniper Lake, has no spawning beds and will require stocking each year. While the season is short yet the rainbows are hardy, scrappy little fellows and Shadow Lake deserves the attention that it would require to keep it replenished.

Grassy Lake is about two miles northwest of Juniper Lake, and about two or three miles farther north is Snag Lake; these two lakes, elevation 7500 feet, surrounded by high timbered mountains are connected by a small creek. Into this creek in May or June of each year comes hundreds of rainbow trout to spawn, and, together with the stocking of the fry supplied by the Fish and Game Commission, the trout have increased until these lakes are of considerable import. While somewhat difficult of access, as they can only be reached by pack train or hiking, the tourist will be well repaid for the effort required to visit the lakes. There are no boats as yet on Snag or Grassy lakes and the fishing must be done from improvised rafts or from the shore, but some of the finest of rainbows up to six pounds have been taken. Snag Lake is second to Juniper Lake in size and Grassy Lake is still smaller, but each seems to be equally well supplied with trout and the fisherman will have rare sport with flies or spinner during July or early August.

Whether or not any fish are caught, a trip to the Cinder Cones at the north end of Snag Lake is worth while and the lava beds and the flow of lava that forms the north shore of the lake are also centers of interest, for they show quite plainly the terrific force of the volcanic action. An action of force has taken place here that is too great for comprehension and the result has been the upheaval of this entire section. After spending a day here, as the tourist returns to Grassy Lake toward evening, he may seat himself on the lake shore, and, looking west toward mysterious Mount Lassen, lose himself in reverie until the great silence of the high mountains gently steals upon him: a profound silence, broken only by the wind in the pines. He may sit thus indefinitely, but when he suddenly arises and shakes off this lethargy the bigness of the out-of-doors has come to him, for he has indeed been close to nature. It matters not to the true sportsman if he has not been able to take a full limit of fish; this fact alone can not spoil his trip for him, and fortunate is the man who can go into the mountains, along the streams and to the lakes and see the wonders of nature and be thankful for his privilege to be among them.

It is a privilege to fish for trout, and added numbers each year are availing themselves of the opportunity to seek the speckled beauties. The rainbow trout, naturally wily and suspicious, has thru his experience with the ever increasing host of anglers reached a degree of "education" that has gained for him the respect that he merits. It is more difficult to make large catches of trout now than it was a few years ago, not necessarily because the fish are becoming so much scarcer, but because, in the humble opinion of the writer, a greater degree of skill is required to take the fish. But this is as it should be, for better and more delicate tackle is needed and the angler must become more and more proficient in its use; then the life and food and habits of the trout come in for study and a field of pursuit is opened up to the ambitious fisherman that soon becomes a man-sized job. Angling for trout should not be merely "fishin'" with the value of the sport measured alone by the number of fish caught, but in the pursuit and capture of each individual fish when the angler has matched his skill, "fish knowledge" and patience against the wary trout, and the fish comes at last to the net, defeated; big indeed is the man who, when his best efforts fail, can admire the trout for his beauty, courage, and cunning.

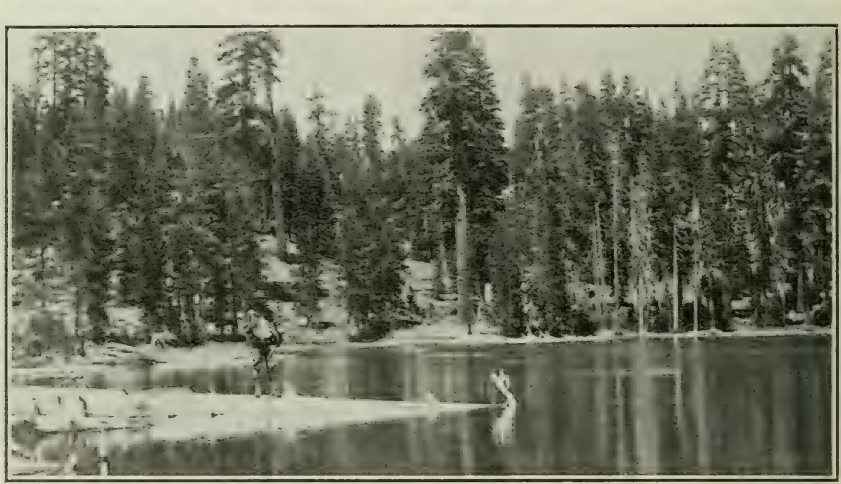

FIG. 78. Shadow Lake, a jewel of the Mount Lassen country, stocked with rainbow trout. Photograph by H. R. Basford.

It is trout fishing that is probably the greatest incentive for taking tourists up into the mountains and if this sport is to be continued it will require much serious consideration and work. Proper legislation giving the fish absolute protection during the spawning season and an increased output from the state fish hatcheries are prime requisites. Each year greater numbers of sportsmen advocate increasing the cost of the angling license to provide more revenue for carrying on the work of propagation, and since it is the angler who must supply this money, who has a greater right to initiate such a movement? Oregon has just increased her angling license fee to $3, and this added amount will permit the Oregon hatcheries and their output to be increased some 300 per cent. A license fee increased to $2 or $3 would enable California to hatch more trout and to give them better protection, but even with increased hatchery facilities the Fish and Game Commission alone cannot make a success of this work without the assistance of the sportsman, for he must help to keep sane laws on the statute books, discourage the fish hog, and cooperate in the enforcement of the fish and game laws.

TIMES HAVE CHANGED.

By J. D. Dondero, Deputy Fish and Game Commissioner.

As the population of California is increasing by leaps and bounds and the public lands are being taken up, it naturally follows that the open country for our game is becoming smaller and smaller each year. The use of automobiles, high-powered guns, improved highways and the ever-increasing habit of our people to get out of doors, are all important factors that are diminishing our fish and game and command our most serious consideration, as the fish and game of our state belong to the people.

A very large majority of the people obey the fish and game laws of the state and earnestly believe in conservation. When a person kills or destroys game out of season, he not only breaks the law but he actually steals this game from the rest of the people. Conditions have changed greatly in the last twenty-five years. People have been educated to realize the importance of conservation measures and where in the past violations were treated lightly, I find the more progressive citizens now to be those who respect the fish and game laws.

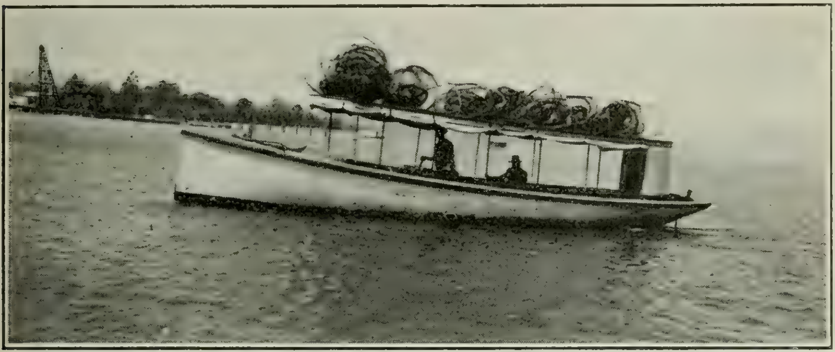

Fig. 79. Launch Freda, used by Fish and Game Commission in patroling Clear Lake, with load of illegal nets.

After a personal survey of the game laws in force in the various states of this country, I find that California has game laws equal to if not better than any in America. We should never advocate any plan tending to commercialize game as this means its destruction.

It is my observation that the deer in this state are holding their own, due in a very great measure to the establishment of game refuges which have been created of late years by the Fish and Game Commission. I believe this to be one of the best achievements accomplished by the Commission, individual and press adverse criticisms to the contrary, notwithstanding. No better plan has been suggested by any of these critics for the conservation of our deer.

The Commission has also been unjustly criticised because certain parts of the game laws are not always evenly applicable to all sections of the state. The Commission has taken great pains to make the game laws and other regulations conflict as little as possible. One can readily see that too many districts with various seasons and laws would necessarily cause a great deal of confusion.

I believe in conservation by education, even having it taught more in our public schools. The great harm done by certain destructions of game should be impressed upon the minds of the young. For instance, the destruction of one female deer means that during a short period of five years, there are thirteen deer less than there would have been otherwise.

For a great many years, it was the custom of the people of this state to hunt in the mountains for the purpose of bringing back a quantity of "jerkey" or dried meat—making a regular slaughterhouse of our hunting grounds. That condition does not exist at this time, thanks to untiring efforts on the part of the Commission. The people of this country who hunt wild game do so nowadays as much for the purpose of getting out-door recreation as to secure meat.

Sporting clubs, gun clubs and protective clubs of various names are being formed all over the country—all with practically the same object in view, that of the conservation of fish and game and to take a more active interest in those matters pertaining to this important subject. The formation of these clubs is a splendid thing and they are doing a good work. They are not only doing good work in the conservation of fish and game but propose necessary legislation, recommend restocking of both fish and game, promote clean sportsmanship and stimulate good-fellowship among men and communities. These clubs are of great assistance to the game wardens in not only apprehending violators, but in greatly diminishing the number of violations. The very existence of these clubs has a splendid moral effect on the would-be law violator. They are not "Squealers' Clubs," as they are sometimes called but when properly functioning serve to *prohibit* violations. To keep game from being wilfully and unlawfully destroyed is worth much more to the people of this state than any prosecutions with their attendant fines, etc., could be after such game has been destroyed.

One of the things that should be discouraged is the raising of hounds for hunting deer. At the time when our bucks are at their prime during the open season, the fawns and young deer need the full protection of their mothers. Ordinarily a hound may run a mother doe a long distance from her young, thereby leaving the little fellows unprotected at night and an easy prey to the skulking coyotes, bob-cats and mountain lions.

If you are a good honest-to-goodness sport, you are the fellow who wants to give your game a fair chance, don't you? Well, try this. When you want to go out hunting deer, next time, take your machine and go to the buck country. Have your camp outfit and a good gun—leave old Fido at home. Get up at break of day, put a sandwich in your pocket, a small canteen of water on your back and light out. Outwit your old buck, and then when the day is over, and later you cast a glance at that noble head resting over your mantle recalling to your mind the thrill of that hunt, you can truthfully say, "I got him on the square."

Times have changed just the same in hunting as other things; the people are realizing more and more that the fish and game belong to the people and it is up to the people to take care of them if we would have any left at all. Remember the territory for hunting is gradually growing less, the army of hunters is rapidly growing larger and the greatest of care must be used by all to preserve the fish and game. During the great World War, in order to avoid a shortage of sugar, flour, etc., our government placed a limit on these articles and we got through all right. Why not apply the same rule to our fish and game—cut down the limits—kill less—save some for the next year and the year after that and so on. We can get the same old invigorating out-door trip with a smaller bag of game and leave some for the next fellow. The inducements for the out-door trip to thousands of people would be missing if there be no fish or game within their reach.

CONSERVATION THROUGH EDUCATION.

By WALTER B. SELLMER, Deputy Fish and Game Commissioner.

Since the dawn of California's history fish and game have played a picturesque and important part in her adventurous and romantic life. It is to protect from extinction the hundreds of varied species of this wild life which forms such a valuable asset to our great California and at the same time give to the sportsmen the greatest possible measure of liberty that the Fish and Game Commission has assigned its game wardens to various parts of the state.

While it is the duty of the game wardens to apprehend the violator of the state's laws for the protection of game and obtain the evidence to convict him, it should not be forgotten that the prevention of the crime is always to be preferred. The conviction of a violator does not replace the life that has been taken. It is merely a means whereby the

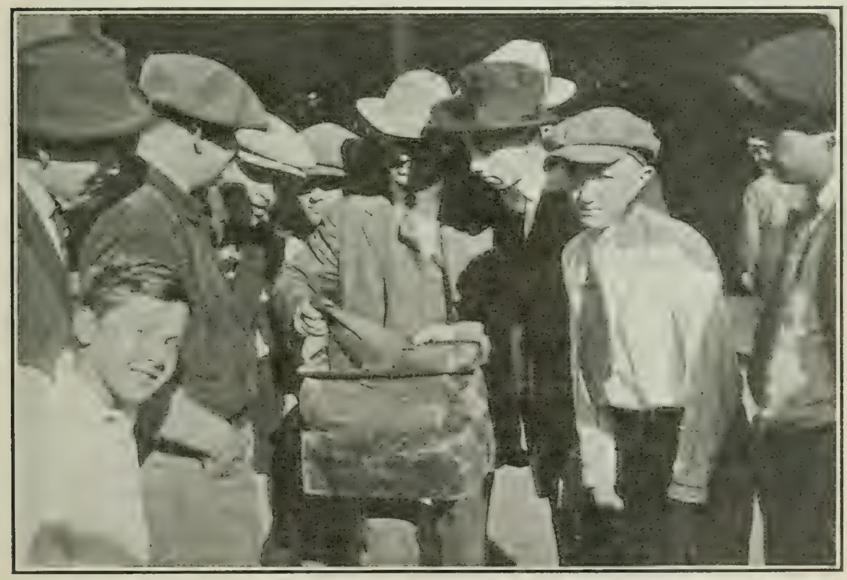

FIG. 80. Searching automobilists for illegal fish and game at Sausalito Ferry, Marin County. Photograph by W. B. Sellmer.

guilty may be punished and a warning to those who would consider the game laws lightly, or the penalties involved in their violation.

The real problem of conservation can therefore be dealt with adequately only when viewed from the standpoint of the prevention of law breaking in regard to the fish and game regulations of the state.

The real game warden does not consider his duty fulfilled when he flashes his star, arrests the violator and confiscates the unlawfully killed game. He realizes that his own efficiency is reflected in the number of violations that take place in his territory, and he endeavors to keep the number down to a minimum.

The price he must pay for this is eternal vigilance. It consists of preaching conservation; of educating the public in his territory what to shoot, when to shoot and how to shoot—or fish, as the case may be—by bringing home to the minds of the sportsmen that the game laws are actually enacted for their good; and by rigid enforcement of the laws so that those who may scoff at these arguments will nevertheless be prevented from breaking the law through fear of arrest and heavy fine.

I have always been a firm believer in conservation through education, in rigid law enforcement with heavy fines for violators, and in the cultivation of public support of the law.

When I took charge of the territory comprising Marin county three years ago the country was badly run down. It was nothing unusual to make several arrests a day. All this meant work for me and plenty of it. During the three years since then I have operated, holding in mind the principles that I have above set forth. And witness the result:

I have gained the confidence of the public and now sometimes as much as a week goes by without a violation taking place.

The game is on the increase. In 1919 there were 215 deer killed. In 1920 the number rose to 250 and in 1921 a grand total of 300 deer were killed in the district.

I was asked the other day how many deputies I had, and I informed the party making the inquiry that there were 1000 storekeepers, ranchers, hotel men and traveling salesmen and that they were all my deputies. By this kind of cooperation I can run down every law violator.

In my opinion the game law violator never succeeds in life and this should form a strong argument for respecting the law. Do you know of a game violator who has ever made a success in life? I don't believe you do and you never will. He never gets ahead because he is always paying penalties, either to a judge or in some other way. The world is against him, including nature herself.

I would like to call to the minds of those engaged in game law enforcement the great assistance I have found in making public through the newspapers the arrests and fines which are imposed. This sets an example to others and I have found this assistance to be invaluable.

WINTER DEER RANGE IN GAME REFUGE ONE D.

By C. O. Fither, Deputy Fish and Game Commissioner.

Practically all of the deer from the summer ranges on the heads of a portion of Coffee and Swift creeks, all of them from the heads of Stuarts Fork, Canyon, North Fork, and the South Fork of the Salmon, come off of these high granite ranges in the fall of the year and down onto the Trinity river, where most of them range from the first of November until the middle of May. The largest number range in a small section of country along the Trinity river from Junction City to Taylor's Flat, within game refuge 1 D. The snow in winter drives these deer into a section of country about five or six miles wide and about thirty miles in length, while in the summer they range over a section of country nearly ten times as large as their winter range. Deer have increased in numbers very rapidly in the refuge during the last few years, which complicates the matter of food supply.

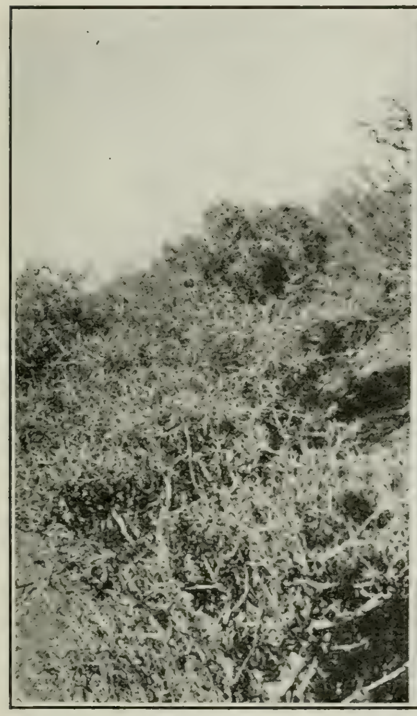

Fig. 81. Appearance of buck brush as result of overstocking of Game Refuge 1D. Photograph by C. O. Fisher.

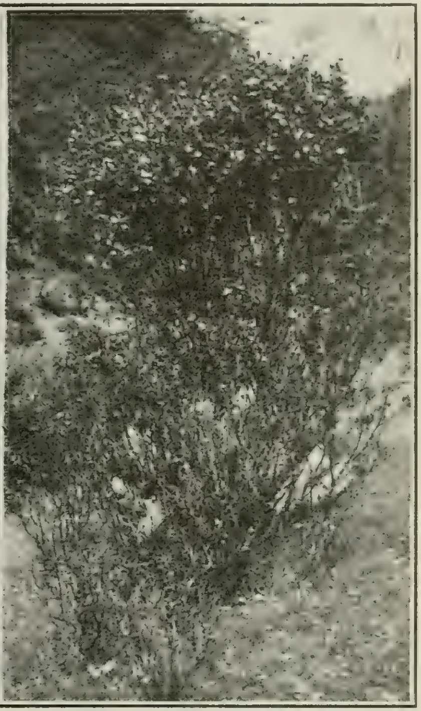

Fig. 82. Manzanita bush in Game Refuge 1D, browsed clean by cattle and deer. It takes starved animals to be interested in manzanita as forage. Photograph by C. O. Fisher.

This range in the refuge north of the Trinity river is at the present time overstocked with cattle, from which the United States Forest Service receives about 75 cents a head per year for the grazing privilege. During the past two years drift stock have appeared in this section and a great number of them have been allowed to run there in the winter. The result is that the brush has been stripped of all of the tender tips that cattle and deer must live on during the winter for there is never any grass until the middle and sometimes the last of April. If you were out early in the morning where the deer are feeding in this refuge you could often see deer raise to the hind feet so as to reach a very few young tips from the brush. This scarcity of food has caused deer to eat the coarse brush and in some instances manzinita and madrone leaves which seems to weaken them so that during the last two winters many have died. This last winter in and near this section mentioned between thirty and forty head of cattle died of starvation, showing clearly that there is not enough feed for both deer and cattle.

During the past two years I have purchased at the expense of the Fish and Game Commission nearly a thousand pounds of salt, to use in salting the deer along the Trinity river, where they seem to be effected the most. This salt seems to help them a great deal and they certainly relish it. A standard of two pounds of salt to each head of stock is not lived up to here by the stockmen. The natural salt licks contain a large amount of arsenic which has its effect on them during the spring months. Most of the weak deer stay along the river section. These are the ones that are affected the most. for those that are higher up have a chance to get good brouse from the brush when the snows' weight flattens it down so that it is within the deer's reach. They also get a good deal of moss that the snow brings off of the trees when it is melting.

The number of lions are being reduced within the refuge by Bert Higgins and John Abbot. who hunt them at all seasons of the year. These men together kill from twenty to thirty lions every year.

BITS OF HISTORY OF TULARE LAKE FISHING.

By S. L. N. Ellis, Deputy Fish and Game Commissioner.

Permit me to refer you back some fifty-five years and more to a time when Tulare Lake had an estimated length of sixty-five miles and a width of forty-five miles. with the waters of Kern. Tule, White, Kaweah and Kings rivers all pouring into it. The vast plains of Tulare. Kern and Fresno counties were then a pasture and we had no Kings nor Madera counties. The settlements were confined to "timber belts" and favored spots in the foothills. The very few ditches for irrigation were confined also to the "timber belt" and were short and small and but little water was diverted from the main channels.

Tulare Lake and the streams mentioned were full of native fish and included the common suckers. Sacramento pike, Sacramento perch, "greasers" and several other fish belonging among the bait varieties. The Sacramento perch were usually dubbed "black perch" and the Sacramento pike generally called "lake trout." Few Sacramento perch ever left the lake proper but were found near the mouths of the various streams. where they congregated to get food that the streams carried to them. On the other hand. the suckers, "greasers" and "lake trout" left the lake annually in the spring high waters and travelled upstream for spawning purposes. It was then that the settlers went fishing and usually armed with a spear that was commonly called a "gig," and hook and line. The Sacramento pike was generally gotten with hook and line baited with frogs, toads or minnows, but the suckers and greasers were taken with the spear. The early settlers were glad to get any of these fish and all were eaten and most thoroughly appreciated, for this was before the introduction of the black bass. The carp, catfish and salmon were then unknown south of the San Joaquin river waters.

I recall two favorable places for the taking of fish in the early days. One at the Dillon Mill, where a trap had been built by the mill operator in the water race which furnished the power to turn the wheels of the old time grist mill. This mill was about four miles from the present town of Exeter and got its water supply from the Kaweah river. The other was the Hard Pan Falls in the St. John's river, near the old townsite called Venice, between Klink and Exeter on the Southern Pacific Railroad. These falls caved in and fell during the flood of 1868 and no visible trace of them remains. Below the falls the fish would congregate in immense numbers and frequently the sight at this stopping place would be similar to looking at a flock of sheep crowded closely together, for the fish could not leap the falls. Many white settlers as well as hundred of Indians came to this place for their fish supply and usually were well rewarded with suckers and "greasers." A few settlers "salted down" a supply for future use while fish were easily gotten.

In the early seventies the "no fence law" was passed and the vast herds of cattle and horses that had grazed the plains were removed to favorable pastures in Arizona and Nevada. Following this came the settler—usually the small grain farmer—who began the opening up of agriculture lines which gave us our present conditions. Immense grain fields they were at first, but gradually cut smaller and smaller into the holdings of today. Immense irrigating canals and ditches were built and all flowing water was diverted from the main channels to supply the orchardist, vineyardist, dairyman and stock raiser. This diversion of water dried up the lower reaches of the streams, which in turn took away the supply of Tulare Lake, with the result that Tulare Lake is today a solid grainfield bounded and cross cut with immense levees and dredged channels. While this change of conditions was going on thousands of tons of fish were destroyed and lost, as there was no market for the common fish; while catfish and perch frequently sold at four cents per pound f. o. b., at some railroad station within shipping range.

Agriculture has claimed and taken away our former fishing conditions and we have but little water left for fish life within reach of the common people.

I have purposely left out trout conditions, for the trout belongs to the tourist and vacationist and not to the man who must do his fishing and return home the same day. There are still hundreds of fishermen who are content to get a mess of carp, pike, or suckers, and nearly any Sunday one can see these fishermen trying the overflow waters of the San Joaquin for the very fish that so many waste and leave on the banks to decay.

We can help these people by returning all fish not really wanted to the water, and by doing this we also relieve the strain on our better grade of fish, for every pound of common fish used relieves the strain on the higher grades. The coming of the automobiles has added thousands to the ranks of the fishermen and unless we honestly and carefully do all that we can our fish supply will soon pass and fresh water fish will be a thing of the past, so far as the valley is concerned. Within the past decade, the writer has frequently seen discarded small catfish, pike and carp, also shad along the places where fishermen left them to rot. Dressed catfish are now worth 30 or 40 cents a pound in the Fresno markets. Carp sell on the streets at 8 and 10 cents per pound, and I have noticed San Joaquin river shad going east to New York by the car load, where they bring a good price. What excuse can any man have for wasting any of these fish? Now is the time for every fisherman to begin returning every fish not wanted by him to the water immediately, or give it to some one who is glad to get it.

CARELESS DEER HUNTING.

By F. A. Bullard, Deputy Fish and Game Commissioner.

There should and must be some means of checking the careless hunter who invades our deer ranges and hunting grounds during the open season for taking and killing deer.

Under our present law for hunting and killing deer, there is no excuse at all for any hunter who wants to be law-abiding to shoot a human being or any domestic stock by mistaking them for deer. The law makes it plain that it is unlawful to kill any kind of a deer unless such deer has at least forked horns, and if all hunters will make sure that their deer is a *legal* deer before shooting no accidents will happen. Neither will he kill any does or spotted fawns as is quite often the case. These accidents—as they call them—can be blamed to two classes of hunters: First, the amateur hunter who never killed or hunted deer before, and goes into the woods thinking that everything that moves before him must be a deer. He sees a moving object, or sees the brush shaking, and without waiting to see if it is a deer, and one that would be a legal deer to shoot, he opens fire on it, at the same time so badly

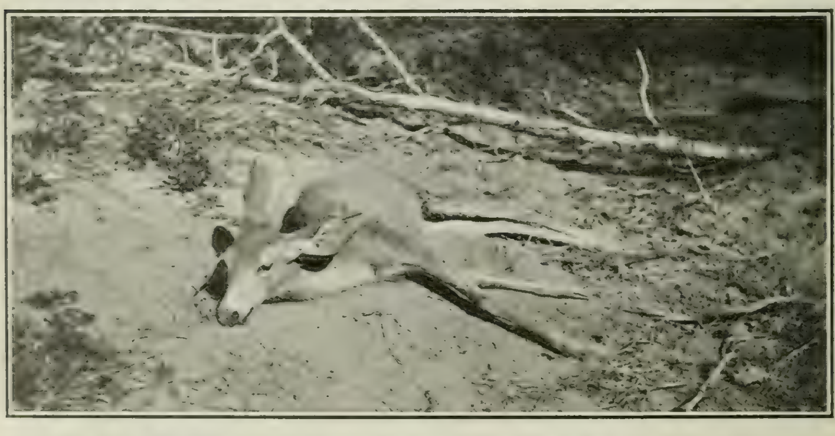

Fig. 83. Doe killed by a careless hunter. The fawns were left to starve. Discovered and photographed by F. A. Bullard.

excited that everything looks like deer and deer horns to him, and only after it is too late to do any good, he finds out that he has shot a man—perhaps his hunting partner—or someone's cow or horse; or if it should chance to be a deer, it is not a legal deer to kill. And then he begins to patch up some hard luck story, of how he saw a big buck run into the brush, and just then this other object showed up and he thought it was the big buck he saw run in there and shot it. Last summer, in and around the General Grant National Park country, there were twelve head of cattle shot and killed, and the year before a like number. There was one man shot and wounded, and several more reported being shot at. And I found many does and fawns that had been shot and left where they fell.

A hunter near Sequoia Lake, Fresno County, shot the doe seen in picture, leaving her where she fell; two poor little fawns were left to starve or be eaten by the coyotes. One instance was called to the writer's attention last summer where a hunter, seeing the brush moving across the canyon from where he stood, took sight at the moving brush and was just in the act of shooting when a man poked his head up out of the brush. This hunter had his gun so near firing that he could scarcely keep from shooting after he discovered that it was a man he was shooting at.

The second class to which accidents may be blamed is what the writer would call the outlaw class. This hunter goes into the hunting grounds with his mind made up that he is going to kill the first deer he sees, buck or doe. He has no respect for the deer law, or any other laws of our country—county, state or national—and will shoot anything he sees if he thinks he is not being watched. Some of this class are good shots and seldom miss the target, and the writer believes them to be responsible for the large number of does and fawns left lying in the woods, merely shooting them to see them fall, and in many cases taking a chance shot in the brush, or taking a shot at long range where it would be impossible to tell a buck from a doe.

Many times I have seen hunters with deer antlers that would barely pass as legal antlers; and in many cases I have heard the hunter boast of what a long shot he made at the deer, where it would have been impossible at more than fifty yards to have seen the branch on the antlers.

As all of our deer ranges are in the mountains and largely in the national forests, the United States Government leases this range to the stock men to range their cattle on during the summer months, that they may market them in the fall of the year; the toll on cattle in these ranges by such hunters is getting to be so heavy that the cattle men can not stand it much longer; and just such hunters are gradually destroying our stock of deer.

FISH AND GAME HISTORY MADE AND IN THE MAKING IN SAN DIEGO COUNTY.

By WEBB TOMS, Deputy Fish and Game Commissioner

It was nineteen years ago the twentieth of July—after returning from the Philippines and receiving an honorable discharge—that I was appointed Deputy Fish and Game Commissioner.

I commenced work with the Commission by patrolling the country on a bicycle. The roads at that time were not much better than trails and it was a hard grind. The next method of travel was by horse and wagon, with the horse "broke to saddle." Then the autos began to come. I got the first "one-seater" coming here, and have had one motorcycle and six autos, and am now using a modern six-cylinder to keep up with the other fellow.

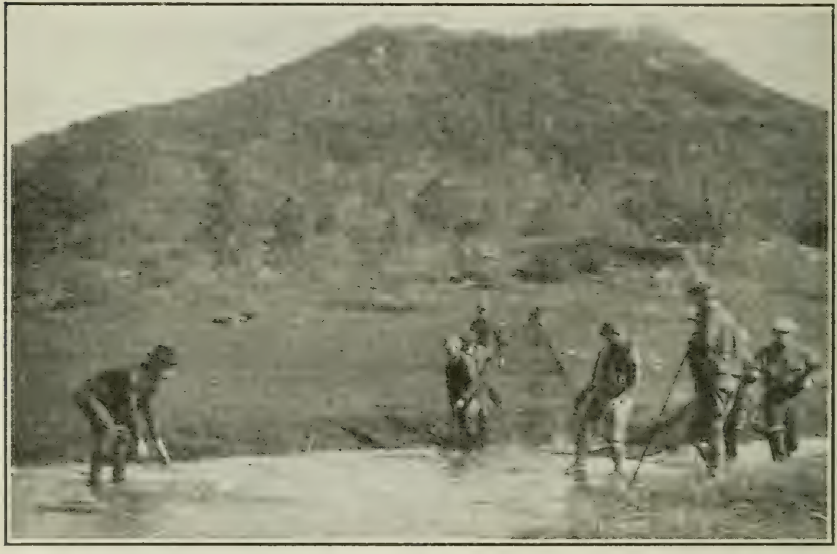

FIG. 84. Rescuing trout from tributary of Cuyamaca Lake, San Diego County, to improve sport in lake.

In this time I have made a little over three hundred cases for violations of our game laws, and lost sixteen of them; and have turned in $6,500 in fines.

Thirty years ago, before there were any laws on quail hunting, market hunters here shipped quail by the hundreds of dozens at a time. Martinis Chick, who at one time was champion wing shot of California, tells me he has shipped quail by the gunny sack full; and in the territory where he did his hunting there is scarcely a quail to be found. I have seen quail in flocks of five hundred birds and plenty of flocks, where today they are about all gone. San Diego was at one time rated the best quail county in the state. There is plenty of good wild country here but the quail, to survive, must have better protection. The open season should be all of December and a limit of ten birds. In my opinion the roadrunner is the worst enemy of quail.

There have been more band-tailed pigeons in San Diego County this year than for several years past. The oak mast was heavy and there was plenty of feed. The heavy snows of last winter drove the pigeons down to the lower hills where there was a good mast from brush oaks upon which the birds fed. If there is a failure of the mast, the pigeons seem to migrate. Some complaint was made of depredations in grain fields last year.

There were over one hundred deer killed in San Diego County last year. This means extermination. As the law is now, at the opening of the season the bucks are with the does, and every man who hunts deer knows what that means—easy to get a buck and the meat not fit for food. There must be a change in the deer law; the open season should be from August 15th (then they are about out of the velvet) to September 15th, and a limit of one buck. The rest of the deer law is all right.

With a liberal supply of trout furnished by the State Fish and Game Commission, San Diego County has started four trout lakes. Cuyamaca Lake has proved a success, and Lower Otay Lake is furnishing two-pound trout this season, as is also Hodges Lake. Barretts Lake was planted only last year. If these last named lakes are as successful as Cuyamaca Lake, San Diego County in two years more will have some very good lake fishing. The picture with net (Fig. 84) shows the forcing back into Cuyamaca Lake, of trout that have spawned in Cuyamaca Creek. The fish did not seem to get back into the lake as they should, and the day before the opening of the trout season, enthusiastic members of our just organized San Diego Fish and Game Association assembled at the creek and we put the fish in the lake. Over two hundred big trout were saved and put back for the lake fishing. If left in the creek, the fish could have been easily taken.

I have talked with sportsmen from the eastern states and they say there is more game there now than there ever was and that it is increasing. Why? Proper laws. I have talked with sportsmen from all parts of California and they say our game is going fast. I know that applies to San Diego County. California has plenty of game country from one end to the other and should have plenty of game. There should be a Fish and Game Protective Association in every county in the state—this to help the Fish and Game Commission to protect what game we have and to get proper laws through the legislature. If the sportsmen of California expect to have resident game much longer, they must wake up before the next session of our legislature, or it won't be long before they can put their guns away—as far as resident game goes.

THE AUTOMOBILE "CONCEALED WEAPON."

By S. J. CARPENTER, Deputy Fish and Game Commissioner.

We find from year to year, as time goes on, more fishermen and hunters, more automobiles, more roads built into the mountains.

When the fishing season opens, I find that two-thirds of the automobile fishing parties have firearms of some kind, and big enough to kill rabbits, quail, doves, and cripple or kill a deer. Two or three parties who believe in the protection of game, reported to me last spring that they saw deer crippled and found them dead from gun-shot wounds; also found dove and quail killed by parties riding along the mountain roads in automobiles.

The only thing that can stop this wanton waste and destruction of the game is to pass a law at the next session of the state legislature making it a misdemeanor for any person to have in possession any kind of gun, pistol or fire-arm, of any size caliber, in any closed district.

We have a law at this time prohibiting shooting from automobiles, but it does not stop the violations as it would if it was unlawful to have firearms *in possession* in closed districts. This law would not affect anyone but the game violator and the stock man, and permits could be issued to the stock man and other parties who were deserving. I have looked through many automobiles and found a small-caliber shot gun or .22-caliber rifle in most of them, the excuse given being that they have it along to shoot jackrabbits or to shoot at targets. Often they give no lawful reason for having it, saying "it is too small to kill a deer," and "they just brought it along."

A law prohibiting any kind of firearm in closed districts would naturally cause quite an objection by those who desire to continue the practice referred to, and no doubt a great many people would oppose it; but it is necessary that something be done to check the use of firearms in closed seasons by the fishing and automobile parties who travel in the mountains, from the time the trout season opens until the deer season closes.

I have noticed, traveling along any of the roads where we have quail and deer, that before the trout season opens the game is very gentle and pays scarcely any attention to automobiles, but a very few days after the trout season opens they are not to be seen, unless it is a crippled one, too sick to get out of sight.

The reader may say, "why don't the wardens catch these violators?" To apprehend all of these violators, with the number of machines on the road at this season of the year, is almost impossible, and, too, if the officer was not on the spot at the time of the violation he can do nothing. In this last statement can be seen one objection to the small-bore gun—it does not make noise enough to be heard a very long distance, and the violator knows there is slight chance of the sound reaching the ear of a game warden.

I think every true sportsman will agree with me as to the soundness of this argument for the enactment of a measure that will do away with this particular form of violation of our game laws.

TROUT CONSERVATION.

By D. E. Roberts, Deputy Fish and Game Commissioner.

The matter of keeping the trout streams of California stocked to withstand the heavy drain they are now and will be subjected to, is becoming a serious matter with the fishing fraternity.

There is no question that the increasing number of automobiles, from year to year, which necessarily means an increase in the number of fishermen and fisherwomen, is the main reason for the heavy toll on trout as well as game.

Dry years and increased irrigation causes the drying up of small tributaries and gulches, which results in a considerable loss in spite of the efforts of wardens and public spirited citizens to save as many as they can by transferring the fish to living waters.

While I personally prefer fly fishing, I do not object to bait fishing, but I do object to the size of the hooks used. I believe salmon eggs should, and some day will, be prohibited. Their use almost necessarily means using a small hook, which a very small trout—often not more than three inches in length—can easily take. Whether small trout are like growing children, always hungry, it is a well known fact to any trout fisherman that the small fry are always ready for anything that looks good to eat, while the larger ones are laying off between meals. A limit of twenty-five, caught on many of our streams, with salmon eggs, would not make a meal for one hungry man, while on the same stream, the same number caught on a fly, (especially if you do not use a midget), or angle worms, or grub worms, would average much better. Some fishermen will contend they take the smaller ones off and put them back in the stream. Granted, but the way I have seen a good many take them off, they had better keep them or kill them and be done.

What we would lose one season by leaving many of the small fry to go over, would return us two-fold next year. I do not wish to be understood as criticising any particular kind of bait or fisherman, except as to the extent and method of taking the fingerlings.

A due regard for present sport, as well as for those who will be coming after, is necessary. A day astream with a dozen or two fair sized trout is more satisfaction than a limit of small ones; and the satisfaction in the knowledge that there are plenty left for yourself or some one else at a future trip should appeal to every true sportsman.

FIG. 85. Deputy D. E. Roberts patroling Tuolumne County.

GAME CONSERVATION IN TRINITY COUNTY.

By G. O. LAWS, Deputy Fish and Game Commissioner.

The major part of Trinity County is enclosed within the national forests, including Fish and Game District 1 D, commonly known as Goat Mountain. This shelter was created in 1915, the result of a petition from the people of Trinity County, addressed to Frank M. Newbert, president of the California Fish and Game Commission, and presented by him to the state legislature for ratification. In circulating the petition, five only refused to sign it, showing that the people in general favored conservation. Of course the refuge was considered an imposition by many who were anxious to kill deer in and out of season, but sentiment has now changed among this class to such an extent that many are now requesting that a second refuge be established or that this one be enlarged. People have awakened to the fact that enforcement of the game laws is not oppression but simply conservation.

At no time has the shelter been seriously encroached upon by violators, and during the hunting and fire seasons, July 1 to November 1, it is strongly guarded. The lookouts on Bally Mountain report immediately to the nearest ranger or the main office at Weaverville, every shot that comes to their hearing. Trinity County has eleven regular deputies the year round: two state and nine forest officials and thirty four-months deputies, making forty-one during the hunting and fire season.

The relation between the forest officials and the fish and game deputies has always been most cordial and this cooperation greatly aids in law enforcement.

While the law governing 1 D is stringent, it deals without favor to anyone. Permits to carry firearms through the shelter, on public roads, must be obtained; also permits to trap fur-bearing animals. First a license, then a permit, if application is approved. Deer meat transported through, must be certified to before a notary public, as all game shelters are classified as closed districts.

The predatory animal hunters of 1 D are John Abbot of Hayfork and Bert Higgins of Helena. They are restricted to panthers, bobcats and coyotes, many of these animals being caught by them each year. No bear are allowed killed at any time within the limits of the refuge.

Salting deer on Bally Mountain, 7000 feet above sea level, has been tried out for the past five years. An increase in the number of deer around the salt logs has been apparent as a result of canvass taken.

Cattle and horses are allowed to graze in 1 D. Close observation shows that, as it stands now, feed conditions toward fall are not enough for all, and if it could be done, game shelters should be what the name implies—for wild animal life only. Deer require different kinds of feed during different seasons of the year; they eat a little grain in the early spring, but are a browsing animal and dainty in their habits. In browsing they pick each leaf separately and contents of stomach shows very few twigs. Deer use their lips for leaf gathering, while cattle use their tongues, and horses bite directly with their teeth.

This refuge is getting to be a show place and the residents of this county are proud of it. The state highway from Helena to Big Bar is inside the refuge and hundreds of deer gather in this section for the winter—in fact, many stay there the year round. Tourists are referred there for pictures and for close range observation—for deer are here to be seen feeding in a natural state, without fear of man.

Among other attractions is a mighty black bear with a white face, and as far as we know, he has for the last four years taken good care to live inside the lines and not far from his cave. People who have seen him say he will dress 700 or 800 pounds. Two white deer also make their home here. The high altitude of parts of the shelter makes it an ideal summer home for animals, the low portions along the Trinity and Hayfork rivers furnish a winter range. Hundreds of mountain quail nest around the lookout station and bushy hillsides.

Composing as large an area of brush and timber lands as it does, only four fires—one incendiary, two from electric storms and one from power lines—have occurred since the shelter was set aside in 1915. This shows when no camping by hunters is allowed, fires are certainly less.

Conservation of game does not mean what many seem to think it does. The game and fish belonging to the people—you, me and everybody. Not to one individual or favored class, as certain people would have you believe. The Fish and Game Commission simply enforces the laws made by the people through their representatives in the legislature, and the wardens must follow the law and instructions as entered in the statute books.

In District No. 1, two deer are allowed to anyone under certain conditions, for the sum of $1.00, and if put on a money basis, the deer should be worth $30.00. On the other hand, for recreation, health and sport no valuation can be placed. Tourists, campers, and all good sports are welcome to Trinity's fishing, hunting and recreation grounds for pure water, health and sport.

SEEKING EVIDENCE.

By M. S. Clark, Deputy Fish and Game Commissioner

In my duties as a deputy of the Fish and Game Commission, I have found it necessary to deviate a little from my fixed rule of operation, in order to catch some wilful violator of the fish and game laws. That rule is never to place myself in a position of encouraging violations, such as talking of violations in a trivial manner when not known to the party addressed, or otherwise encouraging a man to go out and violate a law in order that I may arrest him. But I assisted in "pulling off" one trap which, I think, was justifiable, as the man we were after was a notorious violator.

Some five or six years ago we received a letter from Deputy Bert Miller, at Ukiah, informing us that there was 200 or 300 pounds of dried deer meat at Boonville for sale, and that he thought if we would send a strange man up there, he could arrange to get him in touch with the parties who had this meat for sale. Mr. Hunter, our assistant executive officer, thought I could fill the bill, so I arrived at Ukiah the next morning and went to a livery stable and hired a team of horses and a buggy for the trip to Boonville.

I had been over the road numerous times, but in order to trap our man I was compelled to play the part of a total stranger, anxious to look at a ranch for sale near Boonville; also to get a certain man to drive me over and introduce me to the parties who had the dried meat. Mr. Miller had arranged for this certain man to be in or near the stable when I came in to hire the rig. I informed the stable man that I would have to have a driver as I was not acquainted. He turned to this man and, addressing him as "Less," asked him if he could go with me. He said: "sure."

We got under way. As we passed the Hotel Cecil, I saw Mr. Miller standing on the sidewalk with a broad smile on his face, "sizing" us up. This man "Less" started in by telling me his life's history, which did not interest me at all; so, when we got into the timber and hilly country, I started him on the subject nearest to my heart by asking him if there were any deer in the locality. He informed me that he had killed nine deer the year previous, which did me no good, as, if I had brought him up on his own statement, he would have acknowledged himself to be a liar. He informed me that there were two brothers at Boonville with some dried deer meat, which could be bought, just the information which I expected to get from him.

As we arrived in town, "Less" spied one of the brothers on the street. He stopped the rig and introduced me to the man and asked him for some of the jerkie. This brother informed us that he had sold the meat the day before to a party at Napa but would try to get some meat from a friend of his and would let us know that evening. We journeyed out to look over the ranch I was supposed to buy, and later called on a cousin of "Less's." I remained in the rig and "Less" went in the house to see the cousin, who was in bed with a broken leg.

"Less" came out in about thirty minutes, placed a small package on the seat and we drove back to Boonville. On arriving at the hotel, "Less" took the package in and came out again. We put the team away for the night, and went into the dining room for supper. We were served with two beautiful steaks of the choicest part of a deer. I began to think very rapidly. To take him in would be to spoil the purchase of the dried meat, for which I made the trip. If we ate the meat, the evidence for a conviction on "Less" later would be gone. So I took a gambler's chance and ate the meat, which was delicious. After we had finished, "Less" turned over a small bone on his plate and said, "If there is a game warden in the country who can tell that is a deer bone, I eat my hat." "The best laid plans of mice and men go astray," so when we met our party that evening, he informed us that he could not get any more dried deer meat.

On our return to Ukiah, I informed deputies Miller and Lea of what transpired. They got a search warrant and went to Boonville; got some deer meat from "Less's" cousin, fined him and found out when he had broken his leg.

He had killed this particular deer on the range and in putting it on his horse to bring it in, the horse got frightened and jumped, breaking the man's leg. Quite an expensive deer, I think. In the meantime, we got in touch on the telephone with deputy W. J. Moore, at Napa, who searched the house of the parties who had bought the dried jerkie at Boonville. He failed to find any evidence to convict.

A PATROLMAN'S VIEWS ON CONSERVATION.

By J. L. BUNDOCK, Deputy Fish and Game Commissioner.

In considering the conservation of wild game of our state from the viewpoint of a patrolman, I will take first the bunnies—both cottontail and brush rabbits. These innocent little animals come in for condemnation, for crop failures, and, in fact, for about everything that can not be blamed on something else.

I remember being called to Morago Valley to see the "great damage" that the rabbits had done to a farmer's crop. "Completely ruined" was his complaint. He took me over the field, pointing out the damage done. This is what I saw: One side of his field was bordered with a heavy growth of wild blackberries and poison oak, as well as other brush. For a space of ten or twelve feet there was no sign of grain. What else could you expect? The life of the soil was drawn to the wild brush. I asked to be shown where the rabbits had eaten the grain. He could not show me. I could see no sign of any grain ever having been planted there.

The chief desire of this farmer seemed to be to have a permit to shoot the "bunnies," so that he might invite his "city friends" out for a day's sport.

It is no uncommon request that we deputies receive, to secure permits for farmers to shoot rabbits out of season, claiming great damage is being done. The real reason for the request seems to be, not the damage being done, but a desire to break the law and entertain their friends—with the consent of the Commission.

The rabbits do eat a few vegetables—but why be so hard on them? Do they not have to have food in order to raise their young?

The quail, too, comes in for its share of imaginary damages. I have heard farmers (strange as it may seem) claim that they had "gone broke" on account of the ravages of the quail! Never is the reason given that it is their own poor management.

The deer is not exempt from these "calamity howlers," yet how often do we find the deer coming into the valleys—unless a very severe winter has forced them down from their mountain retreat.

One can readily see how long the game would last, were all requests for permits granted, not considering the vast tollage taken by the persistent violator.

I would advocate heavier fines for a first offense, with the second offense bringing a jail sentence, as the best means of conserving our game.

THE CONSERVATION OF DEER.

By HARRY N. BRITTAN, Deputy Fish and Game Commissioner.

During my three years' service in the employ of the California Fish and Game Commission, most of my work has been in the mountains comprising western Colusa, Glenn, Tehama, northern Lake and southern Mendocino counties, where the deer comprise our most numerous and noted game; and I can notice, from year to year, that the deer are increasing in most localities.

I have had the opportunity to talk with old settlers in some sections of the country where deer winter, and they tell me that some twenty years ago, on these winter ranges, they had a hard time to kill meat enough to eat, and now, on those same ranges, during the winter one may see the deer grazing in countless herds.

This increase is due to the long, hard work of the Fish and Game Commission and its deputies.

The noted hide hunters that devastated our ranges of the buffalo, elk, and antelope were fast destroying our deer in the same manner, but now, through the strenuous efforts of untiring officers of the Commission, those days are gone.

I believe at this time the most dreaded enemy of the deer is the California lion, which thrives principally on them, but is being hunted hard by men with trained dogs and also by trappers. There have been some fifteen lions killed this last winter and spring on the east slope of the Summit Range in this section.

The coyote, also, is very destructive to the deer in the spring of the year, when the fawns are small; and in the winter, when the deer get very poor, they are an easy prey for either the coyote or wild cat. There have been about one hundred coyotes caught in this section this year, and wild cats too numerous to mention.

But now, with the acreage in the mountains that has been turned into game refuges, and the protection that the United States Forest Service is giving in stopping the burning of brush which affords a cover for the deer, they are bound to increase and the next generation to come is to enjoy the same pleasure that we do in hunting this wonderful animal when the season of the law allows.

But the last and most insidious enemy of the deer in the estimation of the deputy, is the nimrod who is classed as a doe-killer. What manner of man is he who, allowed the freedom of this great field of pleasure, will wilfuly go out and shoot down an old doe, and leave the little children of nature to starve, and go on his way, rejoicing to think that some deputy did not see him commit this cowardly act; or, maybe, he will go into camp and tell his comrades about seeing no bucks but lots of does and fawn, but never mention what he did; or perhaps his conversation will lead on to the game wardens and he will tell what he would do if he met one out some place alone; and maybe, by chance, he will meet one, and that violator—how quickly he will change, and he is so sheepish and scared that he can hardly tell his own name or find his license when the deputy asks him for it. The game wardens are always glad to break up the hunting party if need be and drag to justice this kind of man.

THE EASTERN BULLFROG IN CALIFORNIA.

By Tracy I. Storer.

(Contribution from the Museum of Vertebrate Zoology of the University of California.)

The importation and acclimatization of species of plants and animals in lands where they are not native is a subject which has claimed the attention of naturalists and others for a great many years. The colonization of new regions by people from the older long established countries of the earth has almost invariably been followed by efforts to introduce homeland species into the new territory. A notable history of such efforts in respect to one colonial area has just been published* and should be read by everyone interested in the subject. Such introductions in all lands have been mainly of species desirable for food or sport or thought to be useful in some phase of agriculture. Mammals, birds, fishes and plants have consequently been the forms most extensively exploited, though scarcely any group of animal or plant life has escaped attention in this connection. It is desirable, for purposes of future study, to record as accurately as possible the history of each experiment, whatever the outcome, whether or not the species gains a hold in its new location and whether it turns out to be beneficial or harmful to man's interests. And in the case of successful introductions the subsequent progress of the transplant should be recorded. It is with these various points in mind that the following admittedly fragmentary account of the introduction of the bullfrog into California is offered.

On July 12, 1922, Mr. Franc Thiel of Mission San Jose brought to the Museum of Vertebrate Zoology two adult frogs and four very large live tadpoles which he had secured in Sonoma Creek near El Verano, Sonoma County, California. Other frogs of the same species had been caught for food in the same vicinity during the current season. These, according to reports furnished Mr. Thiel by local residents, were ''French frogs'' (which, however, is the local name, throughout California, for any frog suitably large enough to be used as food) and had come from a stock ''brought from France'' some years previously, and introduced into a nearby reservoir. The reservoir had overflowed one winter and the frogs (or tadpoles) became distributed over the surrounding country where they are now living and thriving in numbers. Some boys who visited Boyes Hot Springs in late July this year told the writer of seeing many very big tadpoles which were then ''changing into frogs.''

The frogs and tadpoles proved not to be ''French frogs'' but the common bullfrog (*Rana catesbeiana*) of eastern North America. The adults are comparable in all respects with descriptions and with an adult specimen at hand from New Jersey. The tadpoles far exceeded in size those of any of our native California frogs. One specimen of the latter measured 135 mm. (5⅜ inches) in total length. The ''tooth pattern'' agrees with that shown for the larva of the bullfrog by Wright in his monograph on the Anura of Ithaca, New York (Carnegie Inst. publ. no. 197, 1914, pl. VIII). All of the big tadpoles had the webs and toes of the hind legs well developed and agreed with the form and size of the "two-year old" tadpole of the bullfrog in the eastern states. One of these tadpoles was kept alive by the writer in an outdoor aquarium; by August 21 it had well developed front legs; by September 7 it had completed its metamorphosis.

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*The Naturalization of animals and plants in New Zealand. By Hon. George M. Thomson (Cambridge, at the University Press). 1922. x+1—607 pp.

The writer visited Sonoma Valley on August 27, 1922, and found good and abundant evidence relating to the bullfrog. In pools along the course of Sonoma Creek opposite Agua Caliente tadpoles of this species were found in considerable numbers. These were of three distinct sizes. The largest measured about 5¼ inches in length. All had hind legs fully developed and the front legs had either appeared or were about to appear. These larvae would have changed into frogs within a few weeks at the longest. The second category comprised tadpoles about 2 inches in total length. These, although larger than the fully grown tadpoles of our native creek frog (*Rana boylii*) had no evidences of hind legs. The coloration of these two lots of tadpoles was essentially similar, an olive green upper surface marked with fine black dots and a whitish under surface with little or no iridescence. The third size consisted of tadpoles ½ to ⅝ inch in length. These were mostly black, with scattered yellow markings and with an angular bar of yellow crossing the back just behind the eyes. These three sizes of tadpoles correspond to the descriptions given by Wright (tom. cit., pp. 83-85) for the two-year old, one-year old and newly hatched tadpole of the bullfrog in the eastern states. Presumably they represent egg masses deposited in Sonoma Creek in 1920, 1921 and 1922, respectively.

Local informants told the writer that a stock of frogs had originally been brought in by Mr. Rudolph Spreckels and placed in a reservoir on his country place which is on the east slope of Sonoma Mountain above Sonoma Valley. A letter of inquiry to Mr. Spreckels brought the following information. In September, 1914, and June, 1915, he purchased from H. Goodman and Co., 400-414 Poydras Street, New Orleans, La., eleven dozen "Jumbo Frogs." Also in September, 1914, one dozen large frogs were purchased from C. W. Coombes, a frog merchant of South San Francisco, making a total purchase of twelve dozen frogs. These were all planted in a small lake on his place. This lake or reservoir was emptied during November, 1917, and frogs and tadpoles were allowed to run out a pipe leading from the lake. "Thousands of polly-wogs" are said to have gone into a small creek nearby. This creek leads down the slope of the mountain and joins Sonoma Creek. When seen by the writer on August 27, 1922, the creek was entirely dry, but like other intermittent creeks of the California foothills it doubtless carries a considerable volume of water during the winter months. From the stock carried down in 1917 has come the present population of Sonoma Creek.

A heavy drain is evidently already being laid on the frog population of Sonoma Creek for only two adults were noted by the writer in the several pools examined. Ordinarily the shores of water where frogs have recently metamorphosed are lined with young individuals, but such was not the case here. The explanation lies in the fact that already many persons have become aware of the presence of sizeable frogs in Sonoma Creek and the animals are being hunted for food. One resident of the region had on his gatepost a sign "French frogs for sale." Upon inquiring about his supply I was shown two crudely constructed enclosures with small pools of water. In one of these there were about six large adult male bullfrogs (one of these was 7 inches in body length), while the other pen held about 300 recently metamorphosed individuals of the same species. These had been captured by two boys along the creek and an attempt was being made to "raise" the small frogs for market.

Upon relating the first part of this account to Mr. Edmund Jaeger of Riverside, and showing some of the material to him, he informed me that some of his high school students in biology had this year (1922) brought in some tadpoles of the same caliber. Upon his advice I wrote to one of his students, John Goheen, and shortly obtained three more living specimens of the bullfrog. The frogs in this southern California locality are to be found in a reservoir known as "Mockingbird Lake," situated southeast of the city of Riverside at the mouth of Mockingbird Canyon. There are frogs also in the Gage Canal which skirts the base of the foothills back of Riverside.

Mr. Jaeger stated further that in 1914 when he was a student at the Loma Linda College of Medical Evangelists his instructor in physiology, Dr. A. W. Truman, had on hand some frogs which had been imported from the eastern states. Correspondence with Dr. Truman elicited the fact that he had obtained a large number of frogs from Illinois and some from Louisiana during his years at Loma Linda. Mr. Jaeger stated that the stock of frogs was kept in a cement bottomed lath house on the grounds of the college. The people in the neighborhood complained of the loud noises which the frogs made. [This is indicative of the stock having been bullfrogs. Our local native species of frogs, and the frogs other than the bullfrog which are commonly imported into California for physiological work, are all rather weak voiced.—T. I. S.] The Gage Canal runs directly below the college site and thence for about seventeen miles along the foothills and crosses the mouth of Mockingbird Canyon. Mr. Jaeger makes the suggestion that some frogs from the above-mentioned enclosure probably escaped and made their way into the canal. These adults or some of their tadpoles were then carried down to the vicinity of Mockingbird Lake. In 1922 the school children at Riverside knew of tadpoles "which took two years to change into frogs," so the species must have been established there by 1920 if not earlier.

Still a third occurrence for the species within the state has come to the writer's attention. Mr. Richard Hunt of the Museum's staff recently told me that on April 25, 1920, he had heard "eastern bullfrogs" in Searsville Lake back of Stanford University. Correspondence with Professor G. F. Ferris of the Stanford faculty elicited the further information that the same heavy voices had been heard there by him. Professor J. O. Snyder wrote that some "very large tadpoles" had recently appeared in Lagunita, a smaller lake directly on the Stanford campus.

"Bullfrogs" of unknown species are established in Little Lake, Inyo County, southeast of the Sierra Nevada. These are stated to have been "brought over from France." Verbal descriptions of these frogs were given to Dr. Joseph Grinnell and Mr. Richard Hunt in 1918 and again

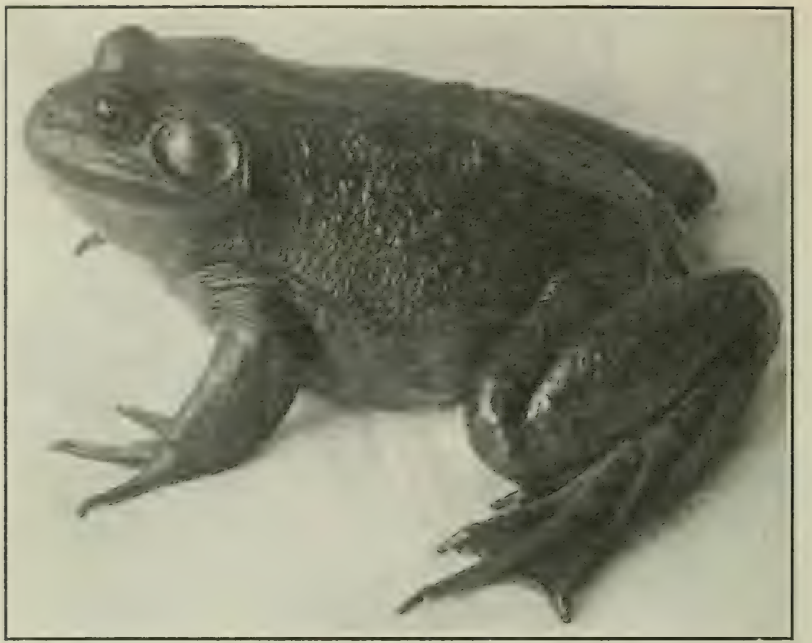

FIG. 86. Eastern Bullfrog. (*Rana catesbeiana* Shaw.) Adult male from El Verano, Sonoma County, California, two-thirds natural size.

to Dr. Grinnell in 1922 by Mr. W. W. Bramlette who owns most of the land around the lake. The reported size of the animals, the strength of their voices, and the nature of the egg mass suggest that the eastern bullfrog is the species in question; but efforts to secure material for accurate indentification have as yet been unavailing. This introduction is believed to have been made about 1915 or 1917.

The accompanying illustration gives a good idea of the appearance of the adult bullfrog. The companion picture is that of our largest

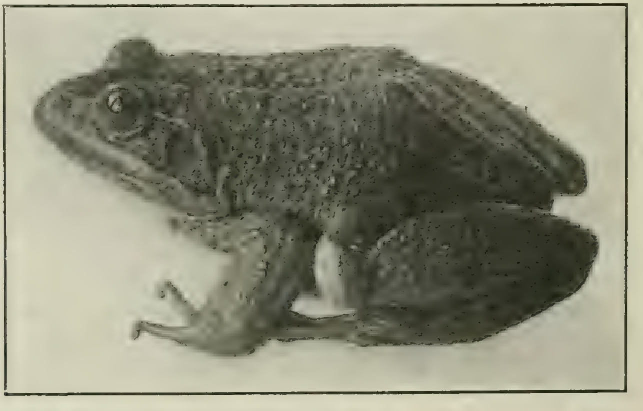

FIG. 87. California Red-legged Frog. (*Rana aurora draytonii* Baird and Girard.) Adult female from near Berkeley, California. Two-thirds natural size.

native frog, the California red-legged frog. Both are figured two-thirds natural size. The outstanding features by which the bullfrog may be distinguished from this and any of our other native frogs are the following:

1. Ear membrane conspicuous, equal to (females) or exceeding (males) the eye in diameter.
2. Low rounded ridge bounds the upper and hinder margins of ear membrane.
3. Back relatively smooth, no large "warts," and no lengthwise folds or ridges of skin.
4. General coloration above dark greenish olive, irregularly and obscurely marked with dark brown; under surface white, sometimes slightly mottled with yellow. No reddish coloration on body or legs.
5. Fourth toe of hind foot webbed clear to tip.

The features by which the tadpoles can be recognized are indicated briefly above, in the description of the material collected by the writer in Sonoma Valley.

The bullfrog is the largest species of North American frog. Old adults, according to Wright (Bureau of Fisheries document No. 888, 1920) may reach a length (head and body) of 8 inches. The present writer has seen a number of California specimens which measured over 6 inches and one which was 7 inches in length. At the time of changing from the tadpole stage into the adult form, the animal measures about 2 inches in length. This is larger than with any of our native frogs at metamorphosis, so far as known. After the two years in the larval stage the bullfrog (according to Wright, 1920, p. 37) requires four years to reach a length of about 4¾ inches; old adults of 7 or 8 inches in length probably require 7 or 8 years to attain such a size.

The native range of the eastern bullfrog extends from the Gulf coast to southern Canada, and from the Atlantic coast westward to the margin of the great plains. In this wide area considerable differences in climatic conditions are experienced, and this may be taken to indicate a considerable degree of adaptability on the part of the species. However, there is one essential requirement of the bullfrog, and that is permanent water. The two year development history of the larvae requires this. The adults are highly aquatic, never going far out on land and spending much of their time actually in the water. In their native haunts, sheltered pools of water containing stumps and brush, as for example old mill ponds, are favored by the frogs, though they live to some extent also along sluggish streams. Here in the west, water reservoirs and the deeper permanent pools of our foothill streams afford suitable environment.

The future history of the bullfrog in California will be watched with interest; the evident success of the transplants here described will doubtless lead to attempts to introduce the species into other localities in the state. Such efforts would be likely to meet with success, provided the attempt is made with due regard to the requirements of the species. The writer would be glad to be informed of any such transplants.

The bullfrog in its eastern haunts is known to partake of a wide variety of living things as food, including small frogs of its own or other species, tadpoles, small fish, insects, worms and at times even small birds. Introduced into suitable waters here, it would probably levy toll on the several classes of animals just indicated. But what effect such transplants may have on the local fauna can not be forseen.

The preceding account may possibly fire some reader to think of establishing a "frog farm" and in anticipation of this the writer would give a few words of caution. There are difficulties aside from those mentioned in the frog story told by Owen Wister's "Virginian." The rearing of tadpoles is readily accomplished in a pond suitably stocked with aquatic plants, as the larvae live and grow on a vegetable diet. But when the tadpoles change into frogs their food habits also change. Thenceforth they take only living animal food. The problem of the "frog farmer" is to supply this food. Thus far no successful means of providing the necessary food has been developed. On one "frog farm" of which the writer has heard the cannibalistic tendencies of the adults were indulged to a limited extent and this provided the food necessary for growth. The larger frogs were allowed to eat some of the smaller ones and some of the tadpoles. But a general segregation in size had to be made in order to keep the stock from becoming solely of adult frogs.

Berkeley, California, September 18, 1922.

CALIFORNIA FISH AND GAME

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NOVEMBER 10, 1922.

A DEPUTIES' NUMBER.

The administration of fish and game resources is largely in the hands of deputies of the Fish and Game Commission, who are locally known as game wardens. These men are held responsible for law enforcement, fish planting, educational work and all matters pertaining to their particular district. There are approximately seventy such deputies in the state. As a rule the warden is known to the average citizen as an officer of the law only. That readers of the CALIFORNIA FISH AND GAME may have a better insight as to the attitude of mind held by these faithful servants of the state, we offer herewith a deputies' number, the contents of which is largely made up of articles and editorials submitted by the various deputies. A perusal of these articles should convince the most skeptical that the men who have been chosen for this sort of work have the right attitude on conservation matters, are sincere, have their work at heart, and are performing a splendid service. It should be remembered that these men are always on duty and frequently work both day and night. Salaries paid them are not large and their chief reward is in the knowledge that they are working to prevent the extermination of a great resource.

If you are a true sportsman and conservationist you will find in your game warden a friend; if you are a violator of fish and game laws, he is rightly your antagonist. We are hoping that this number will interest you in the game warden in your county, and that you will be led to respect the admirable qualities which make him an efficient warden.

THE DEPUTY OF THE FISH AND GAME COMMISSION.

The deputy of the Fish and Game Commission is your humble servant. He is deputized to enforce the fish and game laws and protect your interests in the sport of hunting and fishing. Cooperate with him; lend him a helping hand in making known to him cases where violations of fish and game laws are taking place. The cooperation of the sportsman with the deputies of the Fish and Game Commission will make the cause of protection of fish and game a grand success, and build up for you and your children that sport which you and your forefathers have enjoyed.

The Fish and Game Commission is endeavoring to teach the public to protect its fish and game assets by education, through its deputies, through motion pictures of wild life, CALIFORNIA FISH AND GAME, and publications of various sorts, all of which is bringing the people who fish and hunt closer to the Commission and the ultimate aim—suitable protection of fish and game.

A great many things have been brought to bear upon the condition and protection of our wild life: Civilization has come in. Lands have been settled. Nesting places and spawning ground for fish have been removed. The birds and wild game have moved back. The saw mills, with their modern machinery and logging equipment, have laid waste and destroyed acre upon acre of forest, once the natural protection and home of the birds and wild animals. Irrigating ditches and dams have destroyed the spawning grounds for fish, or stopped their progress up the streams. Not until the Fish and Game Commission recommended laws compelling property owners to screen irrigation ditches from the main stream, were the fish protected and not used for fertilizer in the fields. The laws also compel owners of dams to provide fishways, or ladders, n runarounds around dams, so that the fish can get up over dams to head waters to spawn. All of this is done to protect the people's pastime, the sport of fishing and hunting. In all of this work the deputy plays an important part for it is up to him to furnish the proper information.

Because the deputy asks you for your name and the number of your license, don't think that he is too officious—that he should show you how to catch fish, furnish you with bait or hook *in fashion*, or lead you to a good fishing stream or pool. His duty is to check up licenses and limits, and see that there are no infractions of fish and game laws. A fair, gentlemanly question is always answered in like manner by deputies of Fish and Game Commission.

Treat the deputy of the Fish and Gome Commission as you would like to be treated. Don't brand him as a game violator—or game hog, simply because you hate a man who carries a star and is empowered to enforce the law. Meet the deputy on an equal footing as any other man with whom you come in contact. Be gentlemanly and the deputy will return to you the same respect. The Fish and Game Commission endeavors to have manly men to enforce the laws of the Commission, and when a deputy is found otherwise, the Commission declares a vacancy.—Jos. H. Sanders.

LEGISLATION NEEDED TO PROHIBIT USE OF LONG GUNS.

In the past few years the use of what is termed the "long gun," has been increasing in the duck marshes of the Sacramento Valley, where some men are still trying to make a precarious living by hunting for the market. The "long gun" is an automatic with an extension chamber, allowing the rapid firing of ten shots; in other words, it is a small machine gun. Naturally the resulting slaughter of game is to be compared with that of the machine gun during the past war. Large bore guns are prohibited by law, and certainly the use of an agent of destruction such as this should also be prohibited.—S. J. Carpenter.

TRUE SPORTSMANSHIP.

From time to time a report comes to a deputy of the Fish and Game Commission, during the open season on deer, that a doe or fawn or spike buck has been killed and "*let lay*" by some unknown hunter.

Unfortunately such unlawful killing has been done accidentally and the hunter has not the nerve to pick up his unlawful game, for fear of law enforcement. The game warden, on hearing such reports, makes a very thorough investigation, and in many cases is unable to apprehend the game violator.

A great deal could be accomplished toward the correction of this harmful practice through the education of the hunters along the lines of true sportsmanship. An appeal should be made to the hunters of our state, that should they accidentally kill a doe, fawn or spike buck while hunting, not to let it lie and rot for fear of being arrested for unlawful possession of game but to be a true sport, bring in the unlawful game, surrender it to the nearest game warden or duly authorized officer of the law and swear to an affidavit as to the true conditions under which this unlawful game was killed. Any judge or jury of men in our state, having the true facts of such an occurrence, would gladly take into consideration such facts and render justice to the law and to the defendant, and the meat of such game would not be wasted but would be donated by the State Fish and Game Commission to some charitable institution.

If such a procedure was followed, it would tend to humiliate the hunter, causing him to be more careful next time. The game would not be wasted. The law would be recognized and enforced. Lastly, it would show a cooperation between the true sportsman and the Fish and Game Commission, the result of which would be to the interest of all concerned.—Jos H. Sanders.

NEW POLICY ON FISH DISTRIBUTION ANNOUNCED.

One of the serious problems of the Fish and Game Commission is that connected with the enforcement of the law which provides for the screening of irrigation ditches. In many counties the Commission has made persistent efforts to prosecute violators of the law, but with poor success, owing to the attitude of the district attorney. In order to bring about better cooperation in the enforcement of this important law a new policy has been decided upon. Hereafter, the output from the hatcheries will be alloted to those counties which are enforcing the screen law, and those providing suitable protection for the fish planted in the streams. It seems only reasonable that this course be taken to prevent serious loss of the fish which are reared at considerable expense in the state hatcheries.

MAILING LIST FOR "CALIFORNIA FISH AND GAME" REMODELED.

Attention is hereby called to the fact that the entire mailing list of California Fish and Game is being checked over and all those who have not signed cards during the past year will be eliminated from the list.

Although the Commission is anxious that all those really interested receive the magazine, it is imperative that wrong addresses be righted and that those not interested enough to read the quarterly be dropped from the list.

A SUGGESTED SYSTEM FOR CONSERVING YOUNG TROUT.

The time is growing closer to hand when it will be necessary for the Fish and Game Commission to ask for the power, or to have laws passed, whereby every alternate trout stream shall be closed for one year. The year following, this closed trout stream could be opened and the stream that was open the year previous be closed. By such a system small trout of three to six inches, being caught this year, would have a chance to grow for another year. This would afford the fisherman larger fish for his limit and more sport in obtaining his catch. Too often a deputy inspecting shipments of trout to various parts of the state, finds, on opening up the shipment, a limit of twenty-five fish weighing only two or three pounds. The average fish of such a shipment is from three to six inches. If these trout could have protection and be allowed to grow for one year more, what sport would it be to the fisherman to catch such fish!—Jos. H. Sanders.

DIFFERENT SPECIES OF VIOLATORS.

The field deputies become acquainted with many different kinds of violators of the game laws. Among them is the man who lives twenty miles or more from a butcher shop, has a large family and is hard up. He has some excuse for taking game, but not enough to break the law.

Next comes the city man who never saw a deer, and in open season kills a spike or a doe by mistake. Although he should be punished, he is to be pitied.

Then comes the game hog, who kills bucks and kills more than the limit. It would be a good thing to take his license away from him for a couple of years.

But what may be considered the worst violator—and we have a few in every town—is the fault-finder. He is too lazy to go hunting but he will sit around town and criticise and "knock" the game laws. When the game warden makes an arrest, if this fellow can get to the party arrested, he will do all in his power to get the defendant to stand a jury trial. And when he meets a game warden, he has a big tale of woe and he tells him how the game law is being violated, but never gives a tip, or any facts. He pretends to be a friend, but just as soon as his back is turned, he has his hammer out.

Conservation by education is all right, but a good club would be better for the last named species. He should be classed with the coyote.—J. D. Dondero.

SAVE THE BABY TROUT.

While out trouting one many times comes across a pool in which are many real small trout. Look! Possibly next week this pool may be cut off from the main stream and these little trout have become land-locked; in a short time they die, due to no feed and fresh water. If you can make a little ditch with your foot or stock of wood, from the pool to the main stream, as the water subsides these little trout will move out to the main stream. This small assistance from every sportsman in California would mean much to good fishing and plenty for next season—Jos. H. Sanders.

JUDGE CONVICTS MAN OF OWN PROFESSION.

Judge Jerome Barry of Broderick, Yolo County, believes in enforcing fish and game laws, as evidenced by a recent case in court, the defendant having been found in possession of sturgeon in closed season and offering it for sale. The defendant was a wholesale fish dealer and the justice of the peace, also a commercial fisherman. In fact it was necessary to wait for the justice of the peace to make a drift with his salmon net before he could be induced to try the defendant. The defendant entered a plea of guilty and was fined $20.00, the minimum fine. The justice of the peace sold his catch of salmon to defendant.—W. J. Green.

ALIENS AND HUNTING LICENSES.

The present law which places jack rabbits on the predatory list as not protected, has brought the alien, with his gun, into the field, in the closed season of the game, at the nesting and breeding season. It allows the alien to carry firearms without a permit or license.

A recent case before the police court divulged the fact that an alien took out a $1.00 hunting license, and when found with a concealed revolver in his possession by the police officer, tried to tell the officer, and later the judge, that he thought the state hunting license entitled him to carry a concealed revolver and parade the streets at night. He was fined $50.00 after giving battle to the police in the lower end of Sacramento city.

Numerous fines have ben obtained by prosecuting aliens who have purchased citizen's hunting licenses in the Sacramento district. Typical of the facts in many of these cases is the following. Recently a Greek, who gave the name of Harry H. Campbell, took out a $1.00

hunting license and claimed to be a citizen by parentage. On looking this fellow up, his name was found to be Chris Koropulopuski. Registered under the new alien law of the last session of the California legislature, he told the judge the reason he was not drafted in the war was because he had a wife and child. It was found out later on that this Greek registered during the war, in South Dakota, as an alien. He was fined $50.00 by the judge. A clean-up on such aliens is very much worth while.—W. J. GREEN.

ATTITUDE OF MOUNTAIN PEOPLE ON GAME CONSERVATION.

While performing my work of killing mountain lions, I am brought continually in contact with the mountain people who live in the deer country, and it is a pleasure to note the present attitude of these people in regard to game conservation.

A few years ago, deer of either sex were killed at all times of the year and a game warden was considered an unnecessary meddler. As a result, the deer in many places were almost exterminated. Today, by these same people, the game laws are generally respected and the game warden is a welcome visitor at any time of the year, in most of the mountain homes; usually, too, he has the cooperation of most of the people, who are proud to tell of the many deer that range on and around their ranches.

These people have seen the result of game protection, as many of them have told me that there are twenty deer today where there was one twenty years ago, and now they are very bitter in denunciation of the chronic violator. This changed sentiment is doubtless also the result of the educational work performed by such publications as CALIFORNIA FISH AND GAME, bulletins of the American Game Protective Association, and the sporting magazines and also largely to the personalities and effects of the game wardens and forest rangers.

During the past three years, I have met most of these mountain deputies and forest rangers and have had their cooperation in my work, and I have found them to be, in my opinion, sincere men of good judgment, who use their efforts and influence to prevent violations, whenever possible, by explaining the purpose and benefit of game law enforcement. I believe that to the method and personality of the deputy may be attributed to a large degree, the sentiment of the people in his district.—JAY C. BRUCE.

THE SMALL BOY AND THE ANGLER'S LICENSE.

The instances given in this article of violations of our "trout fishing law" by an element that has no regard for law, and the wiley methods taken to evade the law illustrate some situations which our present law does not cover.

I recall three different instances of recent date, where I have met with young lads fishing for trout before the season was open. One case was in Niles Canyon. A young boy about twelve years of age, was fishing. I watched a grown man approach the boy, bait his hook and retire a short distance away. The boy threw his line. I then walked up to the boy and asked, "What are you doing?" He answered, "Fishing." I told him the season for trout was not open and he must stop. Immediately the man came forward and told me the boy "Too young for license; you no can 'rest him."

Another time, on one of our good trout streams, I saw two men, one much smaller than the other. Gradually I worked my way nearer until I was close enough to see that one was a young boy. The boy had a fishing rod and a bag on the shoulder. The man in this instance, as in the other, baited the hook and removed the fish, walking away each time, then coming back as needed. I watched them for some time, then I approached and asked for his license. The man was immediately "on the job,"—"Leetle boy, he no need license, he just 'leven years old." I asked him for *his* license, telling him I had seen him bait the hook and remove the fish. He replied, "You no can 'rest me, you no see me fish."

One morning, in March last, on Fish Ranch Creek along the Tunnel road, at 6.30 a.m., I found a small boy fishing, using the famous "willow rod and twine string." He had four small trout. I told him to quit fishing and get away before the "rider" found him. Some two hours later, I found the same lad still fishing; this time he had eighteen trout, all sizes up to twelve inches in length. I was somewhat "peeved at him," and took his fish pole. The next day I called upon his parents. His mother said, "I no think eet hurt much for zee small boy to fish—he like fish verry much—one fren' tell heem no can 'rest heem."

I think if parents encourage the boys to fish, and enjoy the fish that the small boy catches, that it is only right that they be held responsible for their son's violation of the law.

The small boy catches as many fish as the sportsman, so why not a license for the small boy who fishes as well as for the small boy who hunts?—J. L. BUNDOCK.

LARGE PROPORTION OF VOTING POPULATION SECURE LICENSE.

Many guesses are made as to the proportionate number of persons sufficiently interested in fishing or hunting to take out licenses. Here are figures from Plumas County for 1921, which show what a large proportion of the population of this county are interested in fish and game. Hunting licenses sold in Plumas county, 1921, 829; fishing licenses sold in 1921, 889; total, 1718. The voting population of Plumas County as taken from register is 2284.

ANTELOPE HERD CAREFULLY PROTECTED.

The California Fish and Game Commission is taking an active interest in the herd of antelope still existing in Modoc County. This herd is really the only sizeable remnant of the former herds which ranged the plains of the state. In past years poaching by Oregon hunters has endangered the herd, as has also reduced food supply during severe winters. Four deputies of the Fish and Game Commission are now stationed within a radius of sixty miles and one man devotes most of his time in protecting the animals. During the past winter a considerable amount was spent in feeding the herd.

TROUT MUST HAVE CHANCE TO MATURE.

Continual complaint comes, especially from coastal streams, that fry planted the year before are continually caught by fishermen the following spring. The conservation of a supply of trout is dependent upon some of the fishes reaching maturity, plus the planting of fish from state hatcheries. Some means must be found for preventing the capture of small fish. The size limit law of several years ago has been discarded and now but two alternatives present themselves. Either by education anglers must be taught to leave the small fish in the stream or every stream stocked must be closed for a year or two to give the fish a chance to mature.

WESTERN ASSOCIATION OF GAME COMMISSIONERS WILL MEET IN SACRAMENTO.

The Western Association of State Game Commissioners has accepted the invitation of the California Fish and Game Commission to meet in Sacramento for a two-day session on December 4 and 5, 1922.

David H. Madsen, president of the organization, states that representatives from nine different states will be in attendance and that many matters of importance will be discussed. As in the meeting last year at Salt Lake City, round table discussion will be emphasized and the special problems of the western states will be considered. It is the intention of this association to make the needs of the western states felt in game conservation.

PUBLIC SHOOTING GROUND-GAME REFUGE BILL.

All sportsmen are watching with interest the progress of the Public Shooting Ground-Game Refuge Bill, (H. R. 5823), which is still before Congress. Late last spring, the House Committee on Agriculture amended the bill in such a way that all moneys collected would go into the general treasury, from which appropriations would be made to carry out the purposes of the bill. This did not meet with the approval of sportsmen, even though many assurances have been given that more money would thus be received by appropriation than was produced by the bill. The intention now is to demand the original provisions of the bill and to add amendments which will do away with the opposition from western states as to the provision which would endanger local control of fish and game.

LAW ENFORCEMENT.

The results of the clean-up of violators of the fish and game laws in the Sacramento Valley show a contrast to attempted prosecutions of, say, ten years ago. The cooperation of the judges at the present time plays an important part in he success of the Fish and Game Commission in making the fish and game laws respected. At one time last winter four violators could have been found in one county jail at one time. One of these men was given a sixty-day sentence and another one a one hundred-day sentence. A violator soon forgets about a small fine but he does not soon forget days spent in jail.

ELK MOVED.

Last spring about twenty elk, which were placed near Pacific Grove by the California Academy of Sciences several years ago, and which have been causing damage in dahlia gardens at this place were captured and moved by the Commission to the Hutchinson Ranch west of

Williams, Colusa county. Hunters have been kept out and the animals seem to be doing well. Four calves have been noted this summer.

One large bull elk apparently wandered away from the herd and took up its home on a ranch in Sonoma County, near Santa Rosa, where it was carefully watched by the owner. When the animal suddenly disappeared, an investigation was made and the animal was found shot through the head by some careless hunter. A reward has been offered by the owner of the ranch for the apprehension of the person killing this elk.

CAMPERS, A PROBLEM IN CALIFORNIA.

Game law enforcement in eastern states is a much easier matter than it is in California. It is soldom that campers are to be seen in the open, even during the summer. Most hunters and fishermen stay at some well known resort and consequently are more easily watched by the game wardens. In California, the number of campers in the mountain districts must nearly reach the million mark. They are scattered in every out-of-the-way district where a passable road is available. As our game wardens can not be everywhere at the same time, it is practically impossible to watch all these recreationists. From this standpoint alone, it is obvious that California should have a much larger proportion of game wardens than eastern states and yet this is not true. States with a much less area and with a smaller problem have twice as many deputies as the state of California.

FRY OUTPUT WILL BE LARGE.

Although conditions earlier in the season make the outlook for a successful output of trout fry from the state hatcheries look very dubious, the final outcome has exceeded expectations. Handicapped by heavy snows and freshets, the spawn-takers at first secured few eggs, but later a splendid take was obtained. It is expected that when the last trout leave the hatcheries for new homes in the streams the total for the season wil be close to twenty-six million, the largest output of trout in many years.

Of special interest was the hatch of cutthroat trout, secured from eggs furnished by the United States Bureau of Fisheries. These cutthroat trout were secured especially for Humboldt County, where conditions favor the planting of this Rocky Mountain species.

STATE FAIR EXHIBIT.

As in past years, one of the distinct attractions at the State Fair at Sacramento in September was the exhibit made by the California Fish and Game Commission. On those days when the attendance was the greatest a count showed 1500 persons, per hour, viewing the exhibit. The panorama of the Sierras was remodeled this year in order to depict a spring scene. Beautiful green meadows and a meandering river, with snow-capped mountains in the distance replaced the old scene. The usual lighting effects, with the addition of a thunder storm, were utilized.

Aquaria contained the different species of trout and all fresh water fishes found in the Sacramento region. Golden trout from mountain lakes at an elevation of 10,000 feet, after a journey of nearly a thousand miles by pack train, truck and railroad, were on display. Baby trout just hatched from the eggs and baby salmon were to be seen in the small model hatchery. The department of education and publicity featured a baby mountain lion which had been caught by the state lion hunter, and some baby flying squirrels. A display of skins of fur bearing animals, display of the publications of the Commission, charts showing the food habits of birds, and framed pictures completed this part of the display.

Those who visit the State Fair can not help but be convinced of the extensive work being carried on by the Commission in caring for and conserving the fish and game resources of the state.

PREDATORY ANIMAL CONTROL ON SPRING VALLEY WATER COMPANY PROPERTY.

Predatory animal control by means of systematic trapping and a strict rule that prohibits hunting have made of the extensive watershed properties of the Spring Valley Water Company in San Mateo County a great game refuge.

The particular area in which trapping operations have been carried on, is the watershed of upper San Mateo Creek and Pilarcitos, lying to the west of Billbrae and Burlingame. It consists of open and wooded country, the latter clothed with firs, oaks, grease-woods and lilacs. Wild oats, hill and valley grasses grow in profusion. There is also alfilerilla and clover.

For years no hunting has been allowed in this, nor in the rest of the San Mateo watershed area, and deer have greatly increased in consequence. Quail, however, appear to have decreased to a very marked extent, and it was to give additional protection to these and other ground-nesting birds that predatory animal control was instituted. The campaign has been carried on vigorously by the Water Company since 1912.

Trapping, some seasons, has extended over an area of $14\frac{3}{4}$ square miles. Last season it covered an area of $10\frac{1}{4}$ square miles. Trapping was done by employees of the company.

The accompanying photograph shows 68 of the 84 animals trapped during the season of 1921-22. Among the animals trapped were a number of feral domestic cats, a large number of opposums, also coyotes, coons, foxes, skunks, weasels, badgers and civet cats. The opposum has spread rapidly, and a total of 39 has been taken since its first appearance in 1918.

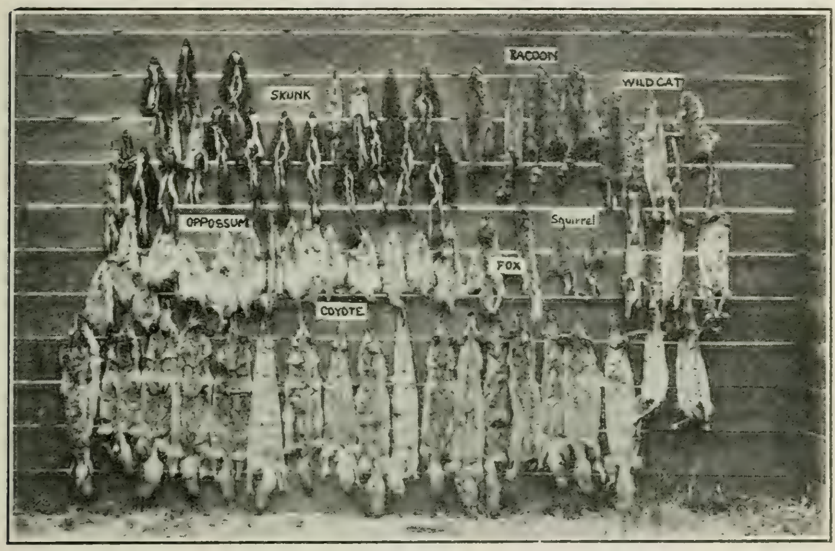

FIG. 88. Sixty-eight of the 84 animals trapped during season of 1921-22 on an area of about $10\frac{1}{4}$ square miles, on the San Francisco peninsula. Photograph by W. B. Lawrence.

The systematic trapping thus carried on constitutes an interesting experiment as to whether predatory animal control leads to a notable increase in game species.

Quail have decreased in number, so doubtless predatory animal control is but one factor in the problem, and there are doubtless others of importance that would be revealed by a more intensive study.

Spring Valley Water Company has always cooperated heartily with the Fish and Game Commission, and will be glad to continue the cooperation, not only along the lines already followed, but also in the solution of this puzzling problem as to why predatory animal control alone is not sufficient to cause an increase in quail.—W. B. LAWRENCE, Millbrae, Cal.

FINED FOR POSSESSION OF UNDERSIZED ABALONES.

On the 26th of January, 1922, Tony Ambra, an Italian of San Francisco, was arrested by Deputy John Burke near Point Pedro in San Mateo County, for having in his possession undersized abalones in violation of section 628*f* of the Penal Code. He was caught as he attempted to hide his illegal catch in his automobile. By actual measurement many of the abalones measured from two to three inches, whereas the minimum size limit is seven inches. The offender was taken before Judge Ray Griffin of Redwood City, who imposed a fine of $100.

DOVES ARE MIGRATORY BIRDS BY LAW.

Whether doves are protected by the federal law was tested during the year in the case of the *United States* vs. *Lumpkin* (276 Fed. 580) in the federal court for the Northern District of Georgia. The defendant, charged with killing mourning doves during the federal closed season, contended that the doves killed by him were not migratory but had remained throughout the year in the state. The court held that the treaty between the United States and Great Britain for the protection of migratory birds declares that mourning doves are migratory, and the fact that an individual bird hunted or killed had remained the entire year within the state is no defense in a prosecution for a violation of the act of Congress to give effect to the treaty. The defendant was convicted and fined.

GAME AN IMPORTANT PART OF MENU ONLY FIFTEEN YEARS AGO.

Alaska and the Canadian Northwest has long been the mecca for big game hunters. Reports of the disappearance of game in these sections now come with alarming frequency. "The good old days" are fairly well described by the following menu which recently came to the hand of the editor:

FRIDAY APRIL 10, 1908

THE KING EDWARD CAFE
Dawson, Y. T., Canada

Short Orders at All Hours a Specialty

Soup	
Clam chowder Bouillon	
Fish	
Boiled white fish, egg sauce	$0.75
Fresh Yukon greyling to order	1.00
Boiled	
Brisket of veal with oysters	.75
Entrees	
Calf moose cutlets with bacon	.75
Roast beef hash, poached egg	.75
Stewed beef and vegetables	.75
Fried eastern oysters on toast	1.00
Roasts	
Prime rib beef au jus	1.00
Loin of pork, apple sauce	.75
Leg of caribou and jelly	.75
Fried eastern oysters on toast	1.00
Cold	
Chicken, $1; Beef, $1; Ham	.75
Extras	
Whole ptarmigan on toast	1.25
Calf brains to order	1.00
Mountain sheep cutlets to order	1.00
Arctic trout to order	1.00
Bear steak to order	1.00
Fresh greens, per order	.75
Fresh ranch eggs, each	.50
Dessert—Pudding	
Assorted pies or cakes	.25
Tea Cows milk, 25c	Coffee

HOW FAR DO BIRDS GO WHEN THEY FLY SOUTH?

The marking of migratory water-fowl, as practiced by the collaborators of the Biological Survey, United States Department of Agriculture, has given evidence that it will be a most interesting and important investigation. Although the work has been in progress for only two years, notable results have already been secured.

The ducks and other birds, whose movements are being studied by this method, are caught, mainly by the use of special traps, light aluminum bands placed on one leg and then released. Every band bears a serial number and the legend "Biol. Surv., Wash., D. C." In the Washington office of the Biological Survey, these banded birds are card indexed so that when a hunter secures a duck bearing one of these bands and reports the data connected with its capture, by referring to the card file, the route covered by the bird in question can be easily ascertained. When such records are received, the hunter is advised where the bird was banded, while the person who attached the band is informed where it was secured.

During the fall shooting seasons for the last few years, a large number of mallards and black ducks, with a few blue-winged teal and other species, have been banded at a small lake about twenty miles north of Toronto, Ontario, and many interesting returns have been received.

Long Range Record.

The best 'long range' record for these Canadian ducks is that of a blue-winged teal, banded September 24, 1920, and killed two months and seven days later, n the Caroni Swamp, near Port of Spain, on the Island of Trinidad, just off the coast of Venezuela. The shortest flight that this bird could have made would be over 3,000 miles. It is a well-known fact that blue-winged teals and certain other ducks that breed in North America spend the winter season in South America, but it was rather a surprise to learn that those individuals that had bred in Canada would make the long flight to South America, because the species also winters in small numbers in the Gulf region and it is to that area that the more northern birds might be expected to go.

The return records of ducks of other species, banded near Toronto, have afforded valuable data relative to their migration. The lake where the banding was done, Lake Scugog, is surrounded by marshes and thus offers excellent opportunities for the ducks to feed and rest before starting the long flight to the south. The trapping and banding was carried on continuously through the autumn, so that by the time the big southward movement began several hundred birds had been marked. At this time the season was open from the Great Lakes to the Gulf of

Mexico and the migrating birds had to run a veritable gauntlet of sportsmen. A large number of 'return records' were therefore received.

Mallards and Black Ducks.

In tracing the route of these birds it seemed apparent that the mallards and black ducks traveled together and their course from Lake Scugog was southwestward along the shores of Lake Erie by way of the St. Clair flats. Here the route divided, the majority continuing toward the southwest, crosscountry to the Ohio River, hence to the Mississippi Valley where many of them spent the winter. The second group, that parted from their fellows in the vicinity of Lake Erie, took a southeasterly route, crossing the Alleghenies and reaching the Atlantic coast by way of Chesapeake and Delaware bays. It is interesting to note that although both of these ducks are present and the black duck is plentiful along the coast of New England, none of the birds marked at Lake Scugog were taken in that region. The question that naturally arises is: Where do those ducks come from? So far we only know that some breed in that area, but we do not know just where the migrating birds come from that use that route. Bird banding will probably supply the answer when it has been applied more intensively at a larger number of stations.

SHELL FISH RESOURCES OF THE NORTHWEST.

Those who have been interested in the recent fish bulletin number 4, on "The Edible Clams, Mussels and Scallops of California" will find additional material along the same line in a recent publication of the Bureau of Fisheries (Document No. 920). The Bulletin is entitled "The Shellfish Resources of the Northwest Coast of the United States," by Charles H. Edmondson.

This bulletin is based on observations made by Mr. Edmondson in 1917-1919, in a survey by the United States Bureau of Fisheries, of the shellfish resources of the northwest coast of the United States including the shore line, bays, and rivers of the State of Oregon and the southern portion of Washington. First the more important shell fish centers, each with its own peculiar characterists, is discussed, and following these, consideration is given to the less important centers. The species of shellfish found in each region and their distribution, relative abundance, and importance are indicated. The report is splendidly illustrated with twenty-five plates showing photographs of some of the regions discussed and of the typical shellfish of the Northwest.

SUMMARY OF 1922 LAWS RELATING TO FUR ANIMALS READY.

The legislatures which met in eleven tates during the year made but few and unimportant changes in the laws relating to fur animals, according to the annual summary just issued by the United States Department of Agriculture, which, through its Bureau of Biological Survey, is charged with the administration of federal laws relating to the fur industry. Copies of the publication, entitled "Laws Relating to Fur Animals, 1922," by George A. Lawyer, chief United States game warden, and Frank L. Earnshaw, assistant, may be had by writing to the department at Washington, D. C.

In Alaska shooting of fur animals is now permitted, but beaver houses or runways may not be destroyed. Foxes certified as disease-free by an official veterinrian of another country may be imported vithout quarantine. In Montana a person suffering damage from beavers may get a permit to take these animals on his own premises, but skins so taken must be cared for, properly cured, and sent to the tate game warden for tagging. A special permit must be secured in order to ship he skin out of the state.

Evidence of illegal shipments of fur has been uncovered in the course of checking up shipments and receipts of furs by the principal fur houses of the country. These cases have been prosecuted and fines and penalties totalling several thousands of dollars imposed.

Not all states offer bounties for undesirable animals, although in most states where predatory creatures give trouble there is a price on the heads of wolves, mountain lions, bobcats, coyotes and simiar destructive animals. Sometimes the county or township pays the bounty. In Wisconsin the state treasurer duplicates all county awards. Seals are considered a pest in Massachusetts, as well as in the State of Washington. Anyone who can catch a panther in New York or California is entitled to $20 bounty. Bears in Pennslyvania have an open and closed season, although they may be kiled at any time in defense of person or property. American trappers receive yearly many millions of dollars for their fur harvest.

ELK HERDS NEED PROTECTION AND FORAGE DURING WINTER.

The estimated number of elk remaining in two large groups in the United States at the present time is only about 52,000, according to the Biological Survey of the United States Department of Agriculture. To insure the permanence of these splendid game animals, which are among the largest and finest of all deer, the cooperation and coordination of federal, state, and all other interested agencies is needed.

The elk of the Yellowstone Park region constitute the only really large herds of big game remaining in the United States, and although these number about 25,000, they are a mere remnant of the great herds which formerly ranged from Maine to California. The northern group, which ranges within the Yellowstone National Park in summer and migrates northward, suffered greatly from the adverse conditions of the winter of 1919-20.

The elk in the southern group are scattered in summer at high elevations in the southern part of Yellowstone Park, and in the mountains of the Teton, Bridger, Wyoming, and Washakie, National Forests. With the first heavy swonfall they descended to lower levels, where their winter range has become more and more restricted by the coming of settlers. Thousands of elk congregate in the path of their former migration in the vicinity of the winter refuge maintained by the Biological Survey at Jackson, Wyo. A winter feeding ground at this point attracts many elk, and it has been found necessary to furnish a supply of hay for them. Feeding is not recommended, however, where natural winter forage in sufficient quantity is available.

The other principal herds remaining on their native ranges are the Roosevelt elk, confined to the Olympic mountains in northwest Washington, and smaller isolated groups, mainly near the Pacific coast, which include the valley elk in a small area at the lower end of the San Joaquin Valley, California. If an elk is estimated to be worth $75, the value of the present herds in the United States would be approximately $4,000,000, which is a substantial national asset.

Within the past 10 years several thousand head of elk have been transferred from the Yellowstone Park region to localities in many states for restocking purposes. In Arizona, where conditions are suitable, these transplanted herds are thriving. In other districts it has been demonstrated that it is unwise to introduce elk on restricted areas near farming communities as more or less injury to crops occurs and claims for damages are to be expected.

The high mortality among elk in recent years has been due partly to weather conditions, such as periodical summer droughts followed by unusually severe winters, and partly to the encroachment of settlers, through whom much suitable winter range is eliminated. Hunters kill elk as game and many of the finest animals become victims of tooth-hunters operating illegally. Mountain lions, lynxes, wolves, and coyotes also kill many.

Adequate winter range, affording sufficient forage, and adequate winter protection must be provided if elk are to be maintained even in moderate numbers. In the opinion of the United States Department of Agriculture, limited areas of hay land urgently needed to supply forage for winter use should be purchased.

FACTS OF CURRENT INTEREST.

The 1922 output of trout from the state hatcheries will be near the twenty-six million mark.

* * *

The dove season just past has furnished plenty of sport to those interested in this bird; limit bags have been the rule.

* * *

Growing interest in conservation is resulting in the formation of many fish and game protective associations. More than a dozen active organizations of this kind are now to be found in the state.

* * *

Motion pictures of the spawning of salmon on the Klamath River will be taken this fall to be used in the educational work of the Commission.

* * *

The overflowing of several sections of grain land in the bed of Tulare Lake the past summer, and the subsequent pumping out of the water, has furnished splendid feeding ground for ducks and these birds have appeared in large numbers. Fortunately there has been no recurrence of the duck disease which decimated the ducks of this region in 1908-1913.

* * *

A reading of this magazine will show that still another non-native species has become acclimated in California. This time it is not a game mammal nor a game bird, but a game amphibian—the bullfrog. The bullfrog is actually hunted for food and for sport and so may properly be termed game.

* * *

The biennial report of the Fish and Game Commission now in preparation, will detail the accomplishments of the past two years. In law enforcement, hatchery output, educational activities, and in fact in all lines of endeavor, they have been banner years.

* * *

Fish are to be furnished hereafter to those counties which will properly care for them. Has your county proper fishways and proper screens at the intake of irrigation ditches? These are necessary precautions in the protection of trout fry.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

SALMON INVESTIGATION.

The salmon investigation which started four years ago with the marking of young salmon at the Mount Shasta Hatchery, is now showing developments of great interest. Dr. J. O. Snyder of Stanford University, in charge of the investigation, has spent the past three months in the field, aided by three assistants. Particular attention has been given to a search for returned marked salmon at the principal trolling districts, Monterey, Point Reyes, Fort Bragg and Eureka. A disappointing number of returns have been secured, but those taken have added interesting information as to the life history and distribution of the salmon. Last year twenty-three were secured; this year two were taken in Monterey Bay, two at Point Reyes, one at Fort Bragg, five at Eureka and only one at the place where the greater number were expected—on the lower Klamath. The results again indicate a wide distribution of the Klamath river salmon during its life in the ocean. It will be remembered that Sacramento salmon marked several years ago, were taken at Monterey, Pittsburg, and Shelter Cove, Mendocino County.

Results this year point to the possibility that the additional marked salmon to be secured this year, when the spawning season begins at the Fall Creek Hatchery on the Klamath, will be males, and that most of the marked females will return next year, five years after their liberation in the Klamath river. It seems reasonable to believe that holding the young salmon in ponds at Mount Shasta Hatchery might make them mature a year later than those reared naturally in the stream.

In recovering marked salmon, light is thrown on the movements of this valuable food fish in the sea, about which little has been known heretofore. From the practical side of fishery conservation, it will furnish evidence as to what streams are being drawn upon in the different trolling districts.

Extensive marking experiments will be carried on this fall on both the Sacramento and Klamath rivers, in order that still further facts in the life history of this species may be found and utilized in protective legislation.

MEXICO ATTEMPTS FISHERY CONSERVATION.

Professor Carlos Cuesta Terron has been placed in charge of the west coast fisheries by the Mexican government. With headquarters at San Diego, California, he will have a chance to study and plan proper protective legislation for the vast fisheries of the Lower California coast, and at the same time will have a chance to study American methods.

Professor Terron promises cooperation with the California Fish and Game Commission in its fishery conservation work and proposes uniform laws on fisheries in the two countries.

CANNERS WILL BE FORCED TO SECURE ACCURATE WEIGHT.

Because of the need for accurate weighing of fish received at the canneries so that the fishery statistics gathered may be correct and also in order that a careful check may be obtained of the amount of food fish sent to reduction plants the Department of Commercial Fisheries is planning supervision by the state sealer of weights and measurer. A meeting of canners looking toward the consummation of this plan was held at Monterey on September 21.

COMMERCIAL FISHING LAWS ENFORCED.

Fish and game deputies working in the San Pedro and San Diego districts under the department of Commercial Fisheries made 131 arrests between January 1, 1921, and July 1, 1922, for violations of the fish and game laws. Thirteen arrests were made for violations of the laws relating to spiny lobsters. Of these two were acquitted, two received suspended sentences, while the remaining nine paid fines totalling $300. Twenty-five arrests were made for violations of Sec. 628*e* of the Penal Code relating to surf fish, croakers, undersized halibut and barracuda. Convictions were obtained in each case and the fines totaled $1,685. Six arrests were made and convictions obtained under Sec. 628*f* of the Penal Code relating to abalones and clams. The fines amounted to $225. Eighteen arrests were made for violations of Sec. 636 of the Penal Code relating to net fishing. One of the eighteen was acquitted while nine received suspended sentences. The remaining eight paid fines totalling $1,100.

Three arrests were made and convictions obtained under Sec. 636½, a special section relating to paranzella and drag nets. Fines were collected amounting to $300. Four arrests were made for using nets within 750 feet of a pleasure pier. Of these two were dismissed and the other two paid fines to the amount of $100.

Sixty-two arrests were made for fishing without commercial fishing licenses and paid fines amounting to $660.

In addition to the fines aggregating $4,370, fourteen nets were seized and confiscated. The deputies also seized and distributed to state and charitable institutions, 271 pounds of abalone, 40,510 pounds of barracuda, 3500 pounds of croaker, 8559 pounds of halibut and 972 pounds of lobsters.

SALMON FISHERY IN DANGER.

The salmon catch in California this year has been so poor that most salmon fishermen and fish dealers are now convinced that the salmon have been overfished and that radical fishing restrictions must be adopted if we are to save the remnant of the run of this valuable fish. The efforts of the Fish and Game Commission during the past several years to restrict the catch have been opposed by both river and ocean fishermen as well as by some of the fish dealers. This opposition, aided by lobyists at Sacramento, has so far prevented proper legislation. If radical measures are not taken at the next meeting of the state legislature to further protect the salmon we are sure to see the same old story enacted again—of action being taken only after the species has become commercially extinct.

FEDERAL POWER COMMISSION DENIES PERMIT FOR KLAMATH DAM.

The Fish and Game Commission's fight to prevent the destruction of the Klamath river salmon run by the erection of impassable dams for the development of hydroelectric power has resulted in the Federal Power Commission denying the application of the Electro-Metals Company to build high dams on the lower Klamath river within the Klamath National Forest. The Electro-Metals Company proposed to develop electric power and transmit it to Trinidad on the Humboldt County coast and there use the power to smelt bauxite ore which they said they would bring from British Guiana.

The Fish and Game Commission protested against the granting of this permit contending that if dams of the height proposed are built on the lower Klamath river the salmon run on the river would be destroyed. It contended also that enough electric power can be generated from the water in the upper tributaries of the streams so that it is not necessary to destroy the salmon by putting insurmountable barriers where the salmon will be prevented from reaching their spawning grounds. It contended that the fish which enter the stream belong to the people of the state and that the people's proprietary right to the fish can not legally be taken from them. The comparative money value of the fish as compared with the power that would be developed should not enter into the discussion although it does constitute a large part of the arguments of power promoters and electrical engineers.

FUNDS INSUFFICIENT FOR SALMON CONSERVATION WORK.

With the growing scarcity of salmon the Fish and Game Commission's salmon conservation work has had to be increased. This has necessarily been accompanied by an increased expenditure of money along this line. There is a necessity for increasing the salmon hatchery work as well as a necessity for increasing the salmon investigation and patrol work. The state spends annually more than $25,000 in hatching salmon and the United States is spending a like amount in this state for the same purpose. The commission desires to increase this work. Added to the hatchery work there is the expense of the salmon patrol and investigation work which amounts to more than $20,000 each year. The Fish and Game Commission receives no appropriation for this work but must finance it out of the revenue from commercial fishing licenses and the very small amount received from the tax on salmon which are canned or salted. The entire amount received from all commercial licenses sold in northern California, together with the tax on salmon for canning and salting is not nearly sufficient to pay even the state's portion of the expense of salmon hatching to say nothing of the patrol and investigation work which are equally necessary. The bulk of the salmon which are caught are used in the fresh markets and the fish which are used in the fresh markets pay no tax for conservation work. It will be necessary in the fight to save the salmon to increase the revenue for conservation work in the districts where the salmon work is being done. Fish used in the fresh markets should be taxed to furnish a revenue sufficient to carry on this very necessary work.

STRIPED BASS DECREASING.

The annual commercial catch of striped bass in California shows a decrease of about 50 per cent since 1915, and along with this decrease in the commercial catch is a decided scarcity of bass in many of the haunts where both anglers and commercial fishermen formerly found them abundant. The present scarcity is most noticeable in most parts of San Pablo Bay and in the mouths of sloughs tributary to it. On the other hand striped bass are apparently more plentiful in some other places and good angling has been enjoyed in places where they had been caught only in very limited numbers before. There are some ardent striped bass anglers who believe that these fish are just as plentiful as they ever were. They believe that some of the sloughs have been fished out by anglers but that in most cases the bass have moved from their old haunts and have to be sought in other places. Commercial fishermen say that the bass are about as numerous as ever but that they have moved and that the best net fishing is to be found in places where the bass were formerly not so abundant.

Most bass anglers, however, are firmly of the opinion that the bass are not only less plentiful but that they are on the road to extermination. It is our belief after reviewing all the evidence that striped bass are not so plentiful and that they are being over fished at the present time. It should not be argued that the falling off of the commercial catch shows that the bass are being fished out by the nets and that there are less than half as many bass as in 1915. It is very much more likely that the 50 per cent decrease in the commercial catch is almost entirely due to the very good restrictive legislation which has been obtained through the efforts of the Fish and Game Commission and the commission's efficient enforcement of the protective laws.

The usual method of protecting fish against overfishing is to restrict the catch and when efficient protective measures are adopted and enforced the resulting decrease in the catch should not be used as evidence that the fish are being exterminated. The scarcity of bass in some of their old haunts about San Pablo Bay we believe is largely due to the bass moving to other regions. This movement is largely due to the pollution of San Pablo Bay waters by the Government's dredging operations about Mare Island and in deepening the channel from Mare Island to Pinole Point. Much dredging has also been done about the mouths of the more important sloughs. The continued stirring of the mud by dredging operations has caused the tides to carry great quantities of silt over the bay and into the mouths of the sloughs where it has settled to the bottom like a blanket and has pretty effectually killed the diatoms and other plant life which form the basis of the food supply of fishes. This condition was called to our attention by Dr. Albert Mann of the Carnegie Institution after he had made a diatom survey of San Francisco and San Pablo Bay waters. Dr. Mann was alarmed by the conditions he found in San Pablo Bay and stated that if we are to preserve our fisheries we will have to guard against the blotting out of diatom life by silt from dredging operations such as taking place in our bays and rivers. There can be no doubt that the pollution of the waters by sediment from the dredgers has caused the bass to largely abandon their old haunts about San Pablo Bay. Oil pollution may also be a contributing factor. The best evidence that striped bass are being depleted by fishing operations is the growing scarcity of large individuals. This is one of the surest signs of depletion and very nearly every one agrees that there are fewer large bass. Striped bass need more protection but protection is more urgently needed in the case of the salmon. As these two fish in the San Francisco Bay region are caught by the same fishing methods and are to a large extent caught at the same time in the nets it is necessary to protect both if we are to protect either, so striped bass and salmon protectionists are proposing to get together and aid the Fish and Game Commission in the better protection of the two fish.

BAIRD HATCHERY AGAIN OPEN.

For the first time in three years salmon eggs are being secured at the Baird Hatchery on the McCloud river, by the United States Bureau of Fisheries. By the middle of September 800,000 eggs had been secured and many ripe fish were being held for spawning. It will be remembered that salmon have failed to reach this station on the McCloud river during the past three years, owing to the Anderson-Cottonwood irrigation district's dam across the Sacramento River at Redding, over which there was no suitable fishladder. Injunction proceedings by the Fish and Game Commission last spring resulted in the remodeling of the dam to allow progress of the fish up the river. The high water in the stream has perhaps been most instrumental in the conditions existing this year, for additional work will probably be necessary to satisfactorily care for the migrating salmon at the dam.

CONSERVATION IN OTHER STATES.

NEW YORK PASSES ALIEN GUN LAW.

New York at its last legislature passed an alien gun law which lines this state up with Pennsylvania, long famous for its alien law. The provisions of the law require every man purchasing a hunting license to state where he was born, or, if foreign born, to produce his naturalization papers before a license can be issued to him. The bill provides further that it shall be unlawful for any unnaturalized foreign-born person resident in the United States, to hunt any wild bird or animal except under the special license issued directly by the Conservation Commission, and to that end it is made unlawful for any such person to own or possess a shot gun or rifle. The special license makes it possible to grant special permission to responsible persons. Provision is also made for the forfeiture of any gun held by an alien without a special license.

Such a law is helpful in many ways. It controls the hunter from the south of Europe, who is ready to shoot everything from a song bird to a deer out of season, and thus facilitates the warden's work, and it will doubtless reduce the number of murders, as it was shown to do in the state of Pennsylvania, by taking away weapons from dangerous characters. Furthermore, it will be an incentive for the alien to become a citizen, for sentiment is growing everywhere in favor of issuing licenses only to those sufficiently interested in this country to become citizens.

UNIQUE HUNTING LICENSE IN MAINE.

One of the most unique hunting license systems in the United States is to be found in the State of Maine, where it costs a resident but 25 cents for a hunting license which is good for life. The state collects but 10 cents out of the 25 cent license, the rest going to the seller of the license. The main income for fish and game administration comes from appropriations and from non-resident license fees.

LOWER CALIFORNIA HAS NEW GAME REGULATIONS.

In the northern district of Lower California new regulations adopted by the present governor fix the period September 1 to February 28 as the open season for hunting game and require separate licenses (fees $10 each) for large and small game; the females and young of deer, antelope, and mountain sheep are protected at all times; the daily limits on deer are 4; antelope, 2; sheep, 2; ducks, 40, and quail, 50.

ALBERTA REDUCES LIMIT ON SHEEP AND GOATS.

Alberta has reduced the limit on mountain sheep and on goats from 2 to 1 each a season, and has provided that the holder of a general license, upon obtaining a special license (fees, nonresident, $25; resident, $2.50), may hunt deer, moose, and caribou in the Rocky Mountain forest reserves of the Province during September and October.

MARYLAND CLOSES SEASON ON DEER.

The close season for deer has been continued in Maryland until 1926, after which the open season will be from November 10 to November 20, and the limit one buck with horns not less than 4 inches long. A fixed penalty of $300 or 90 days in jail, or both, is prescribed for the illegal killing of deer in the state.

MISSISSIPPI'S NEW GAME LAW.

The provisions of the new game law of Mississippi relating to migratory birds practically conform to the federal law and regulations but no provision becomes effective in any county until adopted by its board of supervisors.

INVESTIGATION OF ALASKA PENINSULA FISHERIES RESERVATION.

Dr. Charles H. Gilbert, of Stanford University accompanied by Willis H. Rich and W. P. Studdert, this past summer made a thorough investigation of the Alaska Peninsula Fisheries Reservation to determine whether the present regulations are adequate to keep the fisheries of that district in perpetuity. They investigated the spawning beds, marked many fish with metal tags to determine whether the fish are local in their origin or are merely a body of fish moving through that district to other sections. Upon these investigations will be determined the character of future regulations for the reservation.

FOOD OF PELICAN TO BE INVESTIGATED.

Dr. Henry B. Ward, of the University of Illinois, Urbana, Ill., has been employed to conduct investigations of the pelican in relation to the fishes of Yellowstone National Park, with the view of ascertaining to what extent these birds prey upon the fish and whether or not they serve as hosts for the parasite which infests many of the trout of the park waters.

CARP PROPAGATION IN OHIO.

At the earnest solicitation of the commercial fishermen, the United States Bureau of Fisheries again undertook carp propagation last spring for the third consecutive year at points on the Portage river, near Port Clinton, Ohio. The efforts to obtain ripe eggs met with unusual success, upwards of 92,000,000 being secured for artificial incubation between May 24 and June 24. The fry resulting from these eggs will be liberated on the local spawning areas.

GAME REFUGES TO BE ESTABLISHED IN NEW YORK.

The Conservation Commission of New York is authorized to set aside 100,000 acres of state-owned lands in the Adirondack Park as game refuges, but no area can be so set aside without the approval of the board of supervisors of the county in which it is located.

LIFE HISTORY NOTES.

OPOSSUMS INCREASE IN TULARE COUNTY.

There have been two or three opossums (*Didelphis virginiana*) caught in the Tule river country, east of Porterville, and one was recently caught further south in the Kern river country. A number of years ago Dr. Hardenman of Porterville secured several opossums and turned them loose in the South Tule region. No doubt these are the offspring of the ones turned loose. One was on display in the windows of the Porterville Chamber of Commerce last winter and is now in captivity in the city park.—FRANK P. CUNNINGHAM, Porterville, California.

TROUT GROW LARGE IN LAKE TAHOE.

Lake Tahoe has long been famous for its splendid lake fish. The trout most commonly caught is a variety of cut throat known as the black spotted or Tahoe trout. Large ones, like the one in the accompanying photograph, are sometimes taken. The picture shows Mr. Lorentz holding a fourteen and a half pound black-spotted trout (*Salmo henshawi*), caught near McKinney's during June, 1922.—JOS SAUNDERS, Truckee, California.

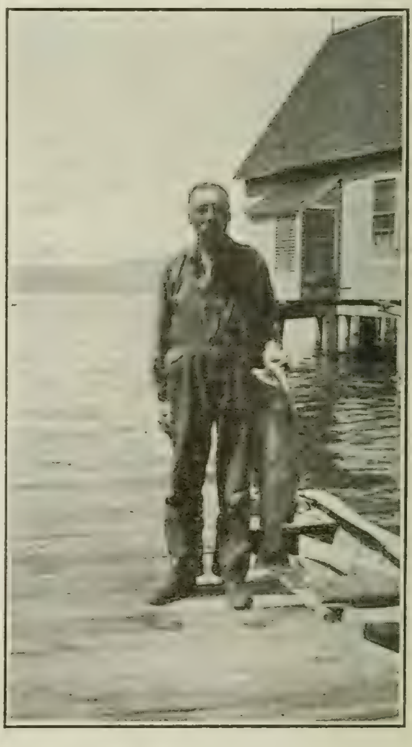

FIG. 89. A sizable black-spotted trout in Lake Tahoe near McKinney's; weight 14½ pounds. Photograph by Jos. Saunders.

FOUR-POINT BUCKS NUMEROUS IN TRINITY COUNTY.

It is becoming more and more important to keep accurate statistics regarding the deer killed in order that scientific data may be available to demonstrate exactly the number of deer that may safely be taken each year without impairing the breeding stock. A careful check of the black-tailed deer killed in my part of Trinity County during 1921, segregated according to the size of the buck, should prove of value in this connection.

Number of five-point bucks	5
Number of four-point bucks	24
Number of three-point bucks	18
Number of forked horn bucks	12
Number of bucks unspecified	60
Number of deer found dead	34
Total	153

There were four horses and sixteen head of cattle shot for deer in Trinity County during the hunting season, and two fatal hunting acidents.—C. O. Fisher, Helena, California.

DOES THE MOUNTAIN LION SCREAM?

Does the mountain lion scream? So far as my experience goes I must say no. The grounds upon which I base my opinion are that I have never been able to connect the mountain lion with any screams I have ever heard in the woods.

For a number of years I believed the mountain lion gave screams and hoots, simply because so many old timers told me they did, but on two or three occasions I followed up the sounds and found the mountain lion did not make them.

When I was a boy growing up an old man lived near us, who came to these parts in the fifties and followed hunting all his life. He claimed to have killed thirty lions, anyway I knew of his killing five or six, and at different times when we were out hunting together, upon hearing these screams, he would say, "Now that is a mountain lion," which he believed to be so. But since, I have followed up the same screams and found them to be made by owls. I myself have never heard the mountain lion make any noise other than a coarse cat-like growling and snarling when angered by dogs.—L. S. Davey, Usona, Mariposa County, California.

AN EARLY FLIGHT OF DUCKS.

For several years I have noted a distinct flight of pintailed ducks which arrive in Colusa County from the 1st to the 10th of August. During the day time they feed by thousands in the grain fields, loafing during the middle of the day on the sloughs. Ducks were late in leaving last spring and I had expected that they would be late in arriving this year, but on August 5th they were to be seen by the thousands. Where do they come from? Certainly they are not local birds. Some maintain that this is the first flight of birds from the north and part of a distinct coastal flight. I am inclined to the theory that they may arrive from further south, as a post-nesting season migration. We need more information on this flight of birds and it is to be hoped that increased banding operations will eventually solve the problem.—S. J. Carpenter, Maxwell, California.

REPORTS.

VIOLATIONS OF FISH AND GAME LAWS.

April 1, 1922, to June 30, 1922.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without a license	3	$95 00
Hunting on posted grounds	1	10 00
Birds—nongame—possession, killing	2	10 00
Birds (shore)—killdeer: possession	1	25 00
Birds—brant—possession	1	----------
Deer—possession, killing, closed season	7	250 00
Spiked buck—killing	1	50 00
Does—possession, killing, closed season	1	50 00
Fawn—possession	1	150 00
Deer meat—possession, closed season	8	200 00
Doves—killing, closed season	1	25 00
Ducks (wild)—killing, shipping, over limit, closed season	2	125 00
Rabbits—killing	2	50 00
Quail—possession, killing, out of season	5	155 00
Hides—illegal possession	1	----------
Taking fur-bearing mammal, closed season	1	----------
Total game violations	38	$1,195 00
Fish.		
Angling without a license	6	$150 00
Blasting fish	1	50 00
Fishing without a license	30	240 00
Fishing in District 2½, closed season	1	25 00
Abalones, undersized, over limit	20	475 00
Barracuda—undersized, possession, selling, illegal	9	475 00
Bass—undersized, possession, over limit, closed season	17	370 00
Clams—undersized, possession, over limit	16	470 00
Crabs—undersized, possession, shipping	9	375 00
Eels (salt water)—undersized, possession	1	20 00
Blue gill—possession, closed season	1	25 00
Lobsters—buying and selling undersized	1	50 00
Perch—possession, closed season	1	20 00
Salmon—selling for profit	1	100 00
Shad—catching with 5-inch gill net	1	----------
Sturgeon—possession	1	20 00
Trout—closed season, over limit	45	805 00
Using Lampara or beach net (seine) in closed district	6	650 00
Using set line in Sequoia Lake	1	50 00
Possession purse net in District 20	5	250 00
Using nets in American District 1	1	250 00
Taking fish within 150 feet of fishway	1	25 00
Taking striped bass with net less than 5½ inches	2	40 00
Taking trout in fish ladder	1	25 00
Discharging offal in Sacramento River	1	25 00
Failing to register fishing boat and gear	2	----------
Total fish violations	181	$4,985 00
Grand total fish and game violations	219	$6,180 00

SEIZURES.

Game.

Ducks	7	Rabbits	1
Quail	2	Deer	1
Spike buck	8 lbs.	Deer meat (jerky)	150 lbs.

Fish.

Abalones	120	Salmon	25 lbs.
Bass	27	Salmon	1
Bass	1,035½ lbs.	Shad	56 lbs.
Barracuda	5,375 lbs.	Shad	12
Clams	1,012	Sturgeon	1 box
Crabs	44 sacks	Lobsters	19 lbs.
Crabs	8,423	Lobsters	33
Eels (salt water)	20	Trout	31 lbs.
Oysters	74 lbs.	Trout	261
Perch (salt water)	5 lbs.	Venison (salted)	20 lbs.
Perch (salt water)	33		

Illegal nets	5
Searches	5

STATEMENT OF EXPENDITURES

For the Period January 1, 1922, to March 31, 1922, of the Seventy-third Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			$89 98		$89 98
Executive offices	$96 11	$4,014 99	1,201 18	$116 75	5,429 03
Printing			921 65		921 65
Research and publicity	26 06	1,050 00	238 05	26 75	1,340 86
Department totals	$122 17	$5,061 99	$2,450 86	$143 50	$7,781 52
Commercial fish culture and conservation:					
Superintendence	$21 01	$2,406 77	$1,073 66	$23 45	$3,524 89
Inspection and patrol	635 58	4,935 00	1,303 15	12 24	6,945 97
Research	175 19	4,546 38	442 63	1,970 43	7,134 63
State laboratory construction	49 70	185 63	3 35		238 68
Statistics	326 10	2,555 15	24 98		2,254 03
Market fishing license commissions			89 50		89 50
Salmon propagation and distribution	732 97	2,838 33	178 16	30 06	3,779 52
Department totals	$1,318 35	$17,497 26	$3,115 43	$2,036 18	$23,967 22
Sporting fish culture and conservation:					
Superintendence	$57 00	$2,850 00	$4,810 26		$7,717 26
General patrol (40 per cent)	212 58	12,394 34	7,143 00	3 95	19,753 87
Trout propagation and distribution	3,008 03	12,337 00	1,495 18	53 23	16,893 44
Department totals	$3,277 61	$27,581 34	$13,448 44	$57 18	$44,364 57
Game conservation:					
General patrol (60 per cent)	$318 92	$18,881 53	$20,588 28	$5 93	$39,794 66
Tahoe camping ground			2 70		2 70
Grand totals	$5,037 05	$69,025 12	$39,605 71	$2,242 79	$115,910 67

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF APRIL, MAY AND JUNE, 1922.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Glenn, Tehama, Colusa	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California
Albacore												496,366	1,852	29,694	437,912	
Anchovies								48,000		73,200		9,903		500	131,603	
Barracuda											490	1,880,048	8,915	486,442	2,375,895	19,343
Bluefish									83	4,017					4,100	
Boccaccio			4					19,809	26,957	171,888					218,658	
Bonito												4,128		6,337	10,465	1,675
Carp		95		2,485		234	9,331	9,478							21,623	
Catfish		14,728				592									15,320	
Chilipepper								16,400	4,272						20 672	
Cultus Cod	4,317	5,205	42					68,412	17,401	12,726	15				108,118	
Dolphin																
Eels																
Flounders	2,732			2,127			2,996	134,221	34,694	86	88	397		44	177,385	400
Grayfish							250	2,600						79,130	81,980	
Greenfish																
Hake								5,772	16,250						22,022	
Halibut	18,336	2,488	889					12,535	3,076	2,820	108,728	578,749	48,983	167,152	943,756	126.565
Hardhead						13									13	
Herring																
Kingfish							25	613	48,258	135,398	35	41,804	106	1,030	227,269	65
Mackerel									22	86,323	39	570,027	7,664	71,448	735,523	165
Marlin																
Mullet														5,011	5,011	
Perch	22,712		8,644				10	5,240	6,477	8,895	195	10,858	148		63,179	
Pike				13		557	135	365							1,070	
Pompano									26	369		5,603		109	6,107	
Rock Bass											55	53,317	4,026	43,653	101,051	
Rockfish	7,679	1,259						99,084	18,302	57,690	4,029	240,577	5,141	137,235	570.996	305
Sablefish								44,908	38,276						83,184	
Salmon	168,457	828,961	3,412	113,859	23,043	160,097	212,550	392,844	381,680	477,219					2,762,122	
Sandabs								237,078	112,494	1,813		5,835	95		357,315	
Sardines								25,675		79,315	60	2,099,375	1,360	528 856	2,734,641	
Sculpin												10,365		1,218	11,583	
Sea Bass—Black												8,591	110	12,761	21,462	90
Sea Bass—White			13							69	7,039	821,444	14,948	140,655	984,168	21,049
Sea Trout								11				627	54	3,270	3,962	
Shad				124		595	102	30,298							31,119	
Shad—Buck				38,809		70,920	184,848	161							294,738	
Shad—Roe				121,604		30,599	489,333								641,536	

Sheepshead												42		643	685	
Skates								23,265	3,375			2,472	138		29,250	
Skipjack																
Smelt	12,066	157	4,732				1,427	24,164	8,646	23,239	36,405	72,265	220	3,106	186,427	123
Sole	36							994,220	456,134	24,562	6,977	36,252	1,532	1,336	1,521,049	
Splittail							189								189	
Striped Bass			632	28,486		55,907	80,229	92,432							257,686	
Stingaree																
Suckers																
Surf Fish																
Swordfish												80		300	380	
Tomcod								5,117							5,117	
Trout—Farm																
Trout—Steelhead																
Tuna												43,913			43,913	
Tuna—Bluefin												166,816		226,872	393,688	18,600
Tuna—Yellowfin																214,620
Turbot			774												774	
Whitebait	8,401		132					37,348							45,881	
Whitefish											390	11,731			12,121	
Yellowtail												299,096	57	136,613	435,766	3,866
Miscellaneous			9				53	10,138	5,454	36	8,446	18,546	383		43,065	
Total fish	244,736	852,893	19,283	307,507	23,043	319,514	981,478	2,340,188	1,181,877	1,159,665	172,991	7,399,227	95,732	2,083,415	17,181,549	406,866
Crustaceans:																
Crabs (doz.)	2,771		41					7505	24						10,341	
Ecrevisse (doz.)																
Shrimps			8,800					384,878							393,678	
Spiny Lobsters																46,363
Mollusks:																
Abalones										439,700	9,657				449,357	30,775
Clams—Cockle	298	574	13,138												14,010	
Clams—Mixed	2,535		3,153				1,965	190				42			7,885	
Clams—Pismo									180		50,295				50,475	
Clams—Softshell	195	1,906	20,570				45,871	21,644							90,186	
Cuttlefish	83		28					3,718	6,140	20,479	37	5,551			36,036	
Limpets																
Mussels							1,123	2,218	35	2,640			9,500		15,516	
Oysters—Eastern (No.)			552,653												552,653	
Oysters—Native																
Snails																
Squid										81,466		9,830		50,159	141,455	
Miscellaneous:																
Frogs (doz.)																
Terrapins (doz.)				10			20								30	
Turtles																5,255

All amounts shown in pounds unless otherwise specified. Albacore and Skipjack cleaned

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A SECOND REPORT ON THE RETURN OF KING SALMON MARKED IN 1919, IN KLAMATH RIVER.

By J. O. Snyder, Stanford University.

In the fall of 1919 a marking experiment was undertaken at the request of Mr. W. H. Shebley, in charge of fishculture, the purpose of which was to obtain additional facts relating to the life history of artificially propagated king salmon. Eggs were taken from Mill Creek, a tributary of the Sacramento River, in November, 1918, and hatched at Fall Creek Hatchery on the Klamath River in February, 1919. Approximately 250,000 of the resulting fry were placed in a rearing pond connected with the hatchery. These were fed and cared for until November, 1919, when they were liberated in Klamath River. In the meantime 25,000 of them were marked by removing the adipose and right ventral fins.

It is presumed that these fish, both marked and unmarked, made their way down the river and entered the sea shortly after liberation. However, nothing was learned of them until the latter part of October, 1920, when some appeared at the racks in Klamath River, a short distance from Hornbrook. Between October 24 and November 14, twenty-three fish, then three-year-old grilse, bearing the mark of this experiment were secured. An account of the experiment and the results obtained to date appeared in CALIFORNIA FISH AND GAME, Vol 8, No. 2.

It was expected that four-year fish of the same lot would be taken during the following season, 1922, and considerable effort was made to secure the cooperation of fishermen and others in obtaining data relating to them.*

Scales and mutilated fins of 7 examples caught at sea, one in the estuary of Klamath River, and fifteen from the racks near Hornbrook, were collected. Reports were received of others having been seen, and also a few deformed fins from fish which had evidently met with accident were examined. Collectors' data relating to the marked fish are here assembled.

TABLE 1.

Summary of collector's data relating to marked fish taken in 1922.

Number	Date	Locality	Sex	Length, centimeters	Weight, pounds	Collector
21751	June 7	Monterey Bay	F.	75	9½	A. Paladini Co., E. M. Nielsen.
21752	June 14	Monterey Bay	M.	79	14½	L. Canepa, Boat 85, A. Paladini Co., E. M. Nielsen.
21756	July 21	Near Redding Rock	F.	64	7¼	Western California Fish Co.
21757	Aug. 1	Near Redding Rock	F.	73	10½	E. C. Scofield.
21758	Aug. 3	Near Redding Rock	M.	73	11½	E. C. Scofield.
21759	Aug. 3	Near Redding Rock	F.	77	11¾	E. C. Scofield.
21760	Aug. 5	Near Cape Mendocino	M.	74	10¼	E. C. Scofield.
[illegible]	Aug. 14	Klamath Estuary	F.	72	10	Klamath River Packing Assn. Frank A. Douglas.
21762	Oct. 19	Klamath racks near Hornbrook	F.	79		Fish and Game egg taking station, E. V. Cassel in charge.
21763	Oct. 28	Klamath racks near Hornbrook	M.	77		
21764	Oct. 30	Klamath racks near Hornbrook	M.	69		
21765	Oct. 31	Klamath racks near Hornbrook	F.	74	-----	E. A. McGregor.
21766	Nov. 1	Klamath racks near Hornbrook	M.	64	-----	E. A. McGregor.
21767	Nov. 3	Klamath racks near Hornbrook	M.	84	-----	E. A. McGregor.
21768	Nov. 6	Klamath racks near Hornbrook	M.	84	-----	E. A. McGregor.
21769	Nov. 8	Klamath racks near Hornbrook	M.	80	-----	E. A. McGregor.
21770	Nov. 8	Klamath racks near Hornbrook	M.	68	-----	E. A. McGregor.
21771	Nov. 8	Klamath racks near Hornbrook	F.	86	-----	E. A. McGregor.
21772	Nov. 9	Klamath racks near Hornbrook	F.	86	-----	E. A. McGregor.
21773	Nov. 10	Klamath racks near Hornbrook	M.	84	-----	E. A. McGregor.
21774	Nov. 10	Klamath racks near Hornbrook	F.	86	-----	E. A. McGregor.
21775	Nov. 11	Klamath racks near Hornbrook	M.	83	-----	E. A. McGregor.
21776	Nov. 15	Klamath racks near Hornbrook	F.	74	-----	E. A. McGregor.

Among other things, this experiment has served to demonstrate beyond doubt that king salmon may range a long distance at sea from the mouth of the parent stream, a matter of great importance in relation to conservation. The salmon caught in Monterey Bay, off San Francisco, and in the Sacramento River have heretofore been considered as a unit statistically and otherwise, in accordance with the supposition that all were a product of the Sacramento basin. This view must now be abandoned, for it was recently shown that Sacramento salmon may migrate northward at least to Shelter Cove, and now there is evidence that Klamath salmon contribute to the catch of Monterey Bay. The experiment also lends aid to the theory that king salmon return to the stream in which they were liberated, regardless of where the eggs were taken.

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*Wardens whose stations were near the coast, were on the lookout from Monterey to Crescent City. E. A. McGregor and E. C. Scofield acted as special observers at Fort Bragg and Eureka; the writer was stationed at the mouth of Klamath River. McGregor was present at the spawn-taking operations near Hornbrook, and finally, willing cooperation and aid were rendered by many fishermen, dealers, and packers.

It will be seen that the sex representation among the marked fish recovered this season is practically even, there being 12 males and 11 females.

The average length of those caught at sea was about 73.5 centimeters, while the mature examples taken later in the river measured about 78. This is similar to the growth attained by stream fish of natural propagation as shown by 60 examples selected at random from the catch of 1919 at the mouth of the Klamath. The sexes of these were equally represented, and they were fish which had spent the greater part of the first year in the river, as indicated by the structure of the scales. The lengths varied from 65 to 80 centimeters, the average being 73.

It will be of interest to continue with similar comparisons. It has been shown that in most cases the size of a salmon at any stage of its growth, may be approximately computed if the length of the fish is known, and some of its scales are available for examination.* The method employed takes advantage of the fact that the scale grows in proportion with the rest of the body, and the structure of the scale is such that it preserves a record of some of the chief incidents in the life of the fish in such a way as to often admit of more or less accurate interpretation. The growth of the scale proceeds from a nuclear center outwards, in concentric rings, forming a succession of minute ridges, each of which for a short time represents the edge or contour of the scale. The scale thus presents in miniature a picture or sketch of the life history of the fish, which records certain events in regular succession. If the growth is rapid and uninterrupted, for a time, the rings are broad and even; if for any reason the growth is retarded, the rings will be narrow or closely crowded.

Figure 2 is a photomicrograph of a portion of a salmon scale (No. 21751 in Table 1) including the nucleus and parts of the opposite edges. The small oval x, represents the scale when it first appeared in the skin, the fish then being approximately 4 centimeters long. The point A marks the edge of the scale when the fish was released from the breeding pond. From A to D is the growth to what may be termed the end of the second year; to E the end of the third year; from E to F, a part of the fourth year. Since the scale grows in proportion with the rest of the fish, the length of the fish at any time will bear a definite relation to the length of the scale at that time. For example, the length of the fish at the end of the third year, is to the length of the scale at the end of the third year, as the present length of the fish, is to the present length of the scale; in this case, L:92::75:128, giving about 54 centimeters as the length of the fish when three years old. In this calculation no account was taken of the growth represented by the small area marked X in the figure, a matter of about four centimeters. With this correction the computed length at the end of the third year would be about 55 centimeters. Here the measurements were made of a magnified image instead of the scale itself, and in practice the camera lucida is used.

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*Dahl, Knut; The age and growth of salmon and trout in Norway as shown by their scales—London, 1910. The method described by Dahl has been employed by Doctor C. H. Gilbert and others in investigations of western salmon.

A table of computed lengths at three stages of growth of the marked fishes taken at sea and in the Klamath estuary* follows:

TABLE 2.

Number	First year	Second year	Third year	Fourth year (actual length)
21751	7.3	36	55	75
21752	7.9	34	58	79
21756	8	31	53	64
21757	8.5	31	56	73
21758	9.9	28	51	73
21759	7.2	34	60	77
21760	8.3	31	50	74
39386	7.2	31	56	72
Average	7.9	32	55	73

According to the table, these individuals measured on the average about 7.9 centimeters when liberated in the river, 32 when two years old, 55 when three years old, and 73 when they met death in the fourth year. These calculated measurements compare favorably with those obtained in another way as will be seen. One hundred fingerlings were taken at random from those liberated in 1919. These measured from 7.1 to 11 centimeters, the average being about 8.5. Fifty fish in the third year, and with a similar stream history, taken in Monterey Bay between April 25 and June 27, averaged about 55 centimeters. Also measurements like those given in the above table were computed from the scales of 60 four-year-old Klamath River examples with a similar stream history, resulting as follows:

	First year	Second year	Third year	Fourth year
Average males	12	35	55	71
Average females	11	34	57	74

From these comparisons it seems safe to infer that the growth of these pond-reared fish has progressed at about the same rate as others, and that when mature they reached about the same size.

The return of three-year fish bearing the mark of 1919 was noted on a previous page. These fish were distinguished by a peculiar and characteristic second year record borne by their scales, an illustration of which is presented as figure 3. Like that shown in figure 2, this scale has a nuclear area A, beyond which the rings are wider and very regular to the point B. From B they are still wider to C, where a check in growth is recorded by a space of two or three irregular and narrow rings. Beyond this the growth is resumed, only to be checked again at D. The space between A and D represents the growth from the time the fingerlings were liberated until the end (winter) of the second year. It is very probable that the check B occurred during the first winter, about the time the fish was one year old, the entire growth of the first year being from A to B. However, speculation as to the time or cause of the checks B or C is of little moment compared with the mere fact of their presence, not only in the scales referred to, but also in all but three of the 46 fish (two more are illustrated in figure 4) which were captured last year and this, bearing the 1919 mark. These checks are to be interpreted as the records of certain events which retarded the growth of each of these fishes at the same time and in a similar way, and their presence in all, or nearly all, would lead one to infer that they were closely associated during the second year. Some explanation other than exposure to the same environment during the growth of the second year may perhaps be found for the remarkable similarity of scale structure in all these individuals, but none more simple or plausible comes to the writer at this time.

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*Scales from fishes approaching the spawning period, like those taken at the racks near Hornbrook, are too badly absorbed or frayed along the edges to be useful in this way.

As the marked fish were only a small part of the 250,000 liberated at the same time, it was suspected that many unmarked individuals might be associated with the marked ones wherever the latter were found, and that such might be recognized if they possessed the same peculiar scale structure as the marked ones. Accordingly, on the day when the first marked one appeared in the estuary of Klamath River, the scales of many other fish were examined, but without success. It was like searching for the proverbial needle in a haystack, for there were at the time, 4632 large fish on the cannery floor. However, better results followed an examination of the sea catches. As the Eureka observer, Mr. Scofield, discovered marked fishes, he preserved scales from all other individuals in the same boat, and a search among 155 of these revealed six which the writer is satisfied may safely be regarded as fishes of the 1919 planting. A scale of one of these is illustrated as figure 5, and it is only necessary to place it alongside of figures 3 and 4 to be convinced of its detailed structural resemblance to them. Collector's data relating to these are here tabulated.

TABLE 3.

Number	Date	Locality	Sex	Length
41853	August 1	Vicinity Redding Rock	male	66
41854	August 1	Vicinity Redding Rock	male	77
41995	August 5	Off Cape Mendocino	female	69
41997	August 5	Off Cape Mendocino	female	67
42021	August 5	Off Cape Mendocino	female	72
42043	August 5	Off Cape Mendocino	female	87

Each of these fish was in its fourth year. Measurements similar to those presented in Table 2 are here recorded for purposes of comparison:

TABLE 4.

Number	First year	Second year	Third year	Fourth year (actual length)
41853	9.5	37	47	66
41854	10	39	65	77
41995	10	35	54	69
41997	10	30	49	67
42021	9	29	55	72
42043	9.5	32	58	87
Average	9.6	34	55	73

The structure of that part of the scale produced during the third and fourth years offers nothing peculiar or distinctive. The time and place of capture of the marked fish do not disturb the supposition that they may have all been taken from the same large school which was passing along the coast in pursuit of food. The first marked fish of the season were caught in Monterey Bay in June. They were next met far to the north near Redding Rock, then off Cape Mendocino at a later *date, in the estuary of the Klamath, August 14, and finally in the upper Klamath River in October and November.

It is probable that others of this planting still remain in the sea, either to be caught during the coming season or to return to the spawning grounds later in the year.

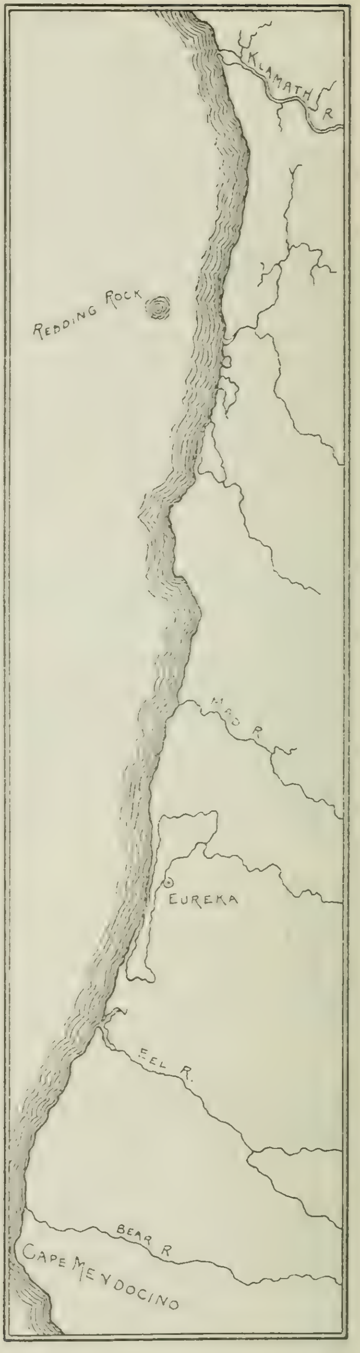

FIG. 1. Map of northern California coast, showing mouth of Klamath River and salmon fishing grounds.

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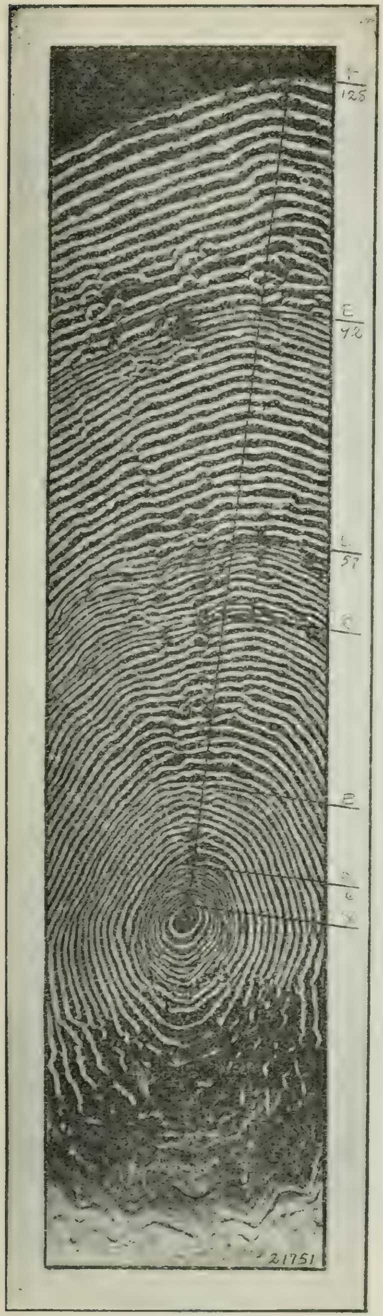
*The table, No. 1, gives July 21 to August 3, as dates upon which marked fish were taken at Redding Rock, and August 5 as the time of catching those at Cape Mendocino. These were the dates of arival of the fish at Eureka. Either may have been taken a day earlier.



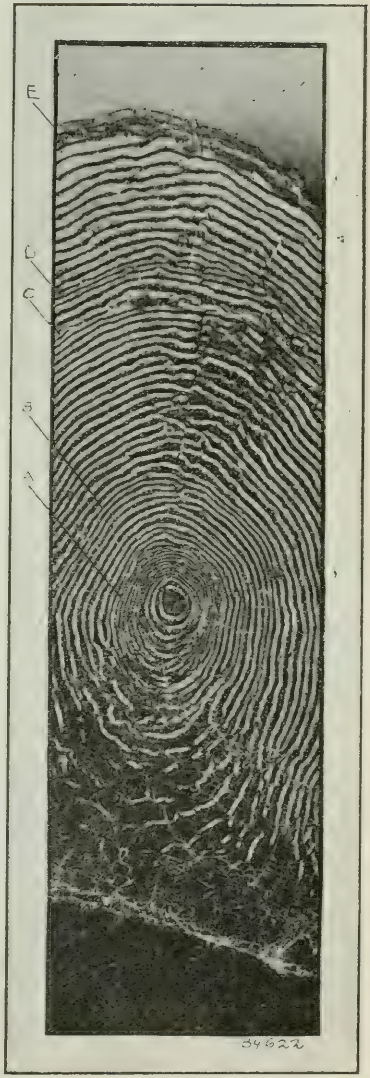


PLATE 1.

FIG. 2. Photomicrograph of a scale from a marked king salmon taken in Monterey Bay, June 7, 1922; a female measuring 75 centimeters in length.

FIG. 3. Photomicrograph of a scale of a marked king salmon which matured in the third year and returned to the upper Klamath River in 1921.

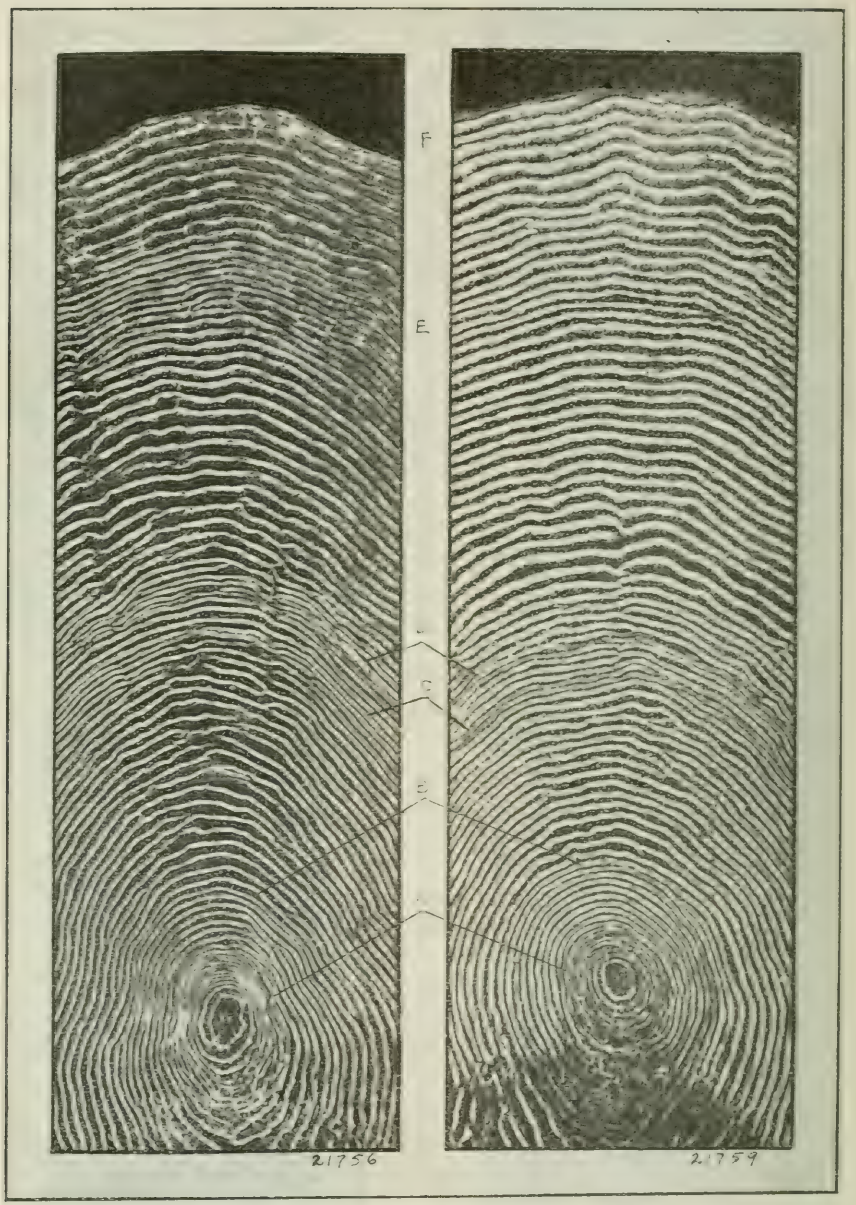


PLATE 2.

FIG. 1. Photomicrograph of scales of two king salmon caught at sea in the fourth year of their age.

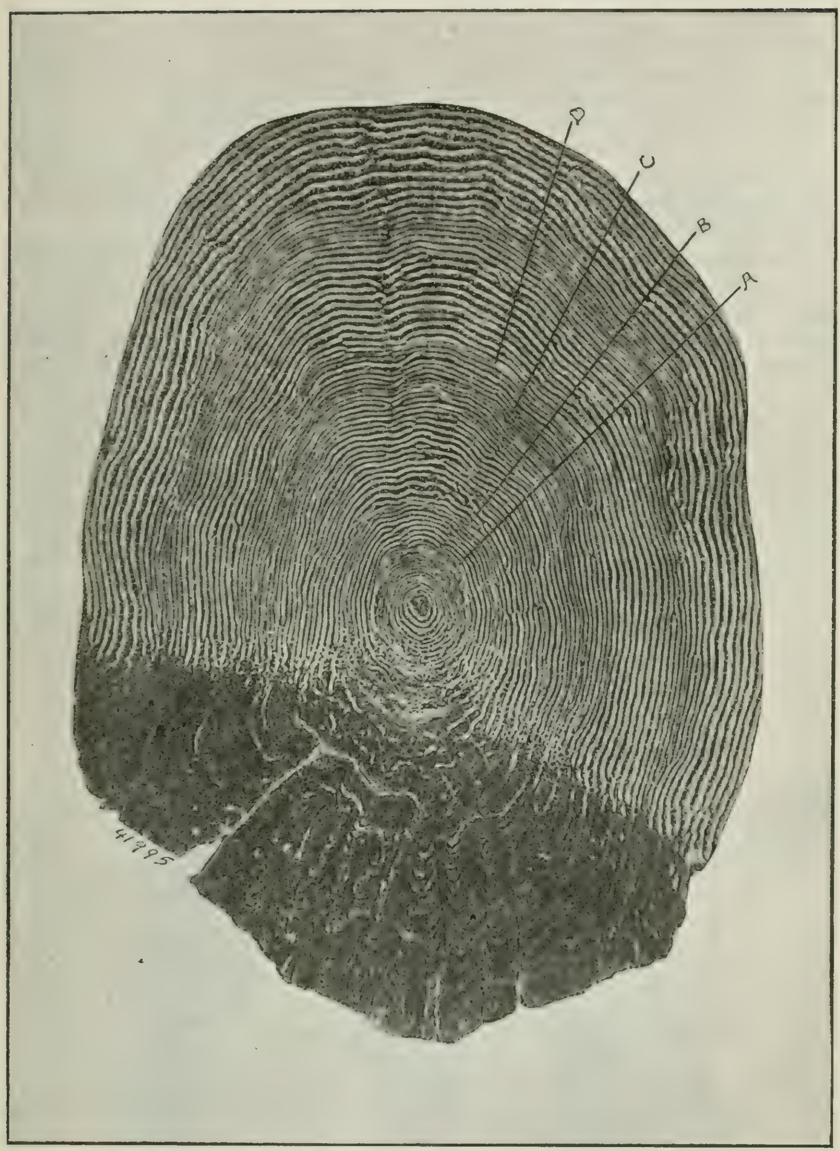


PLATE 3.

FIG. 5. Photomicrograph of a scale of a salmon taken off Cape Mendocino, August 5, 1922, which shows convincing structural resemblance to scales of fish of the 1919 planting.

THE IDENTIFICATION OF TROUT.

By J. O. Snyder, Stanford University.

Anglers are generally interested in knowing the fish which they catch, and some species, especially the trout, offer considerable difficulty and occasionally cause an appeal for identification to the ichthyologist. In most cases the request is not accompanied with sufficient information to permit of an intelligent answer. Color, particularly that of the flesh, which is extremely variable, is usually emphasized while anatomical structures of importance are overlooked. Professor J. G. Brown of Stanford University lately discovered a method of preparing the necessary data which is at the same time ingenious and efficient.

Four species of trout were being caught by the members of a party of anglers in the high Sierra, and as a result of discussions relative to their identity, a specimen of each was prepared for future reference. Instead of taking off the skin, or salting the fish, or preserving it in spirits—of which the supply was probably low, the fish was simply

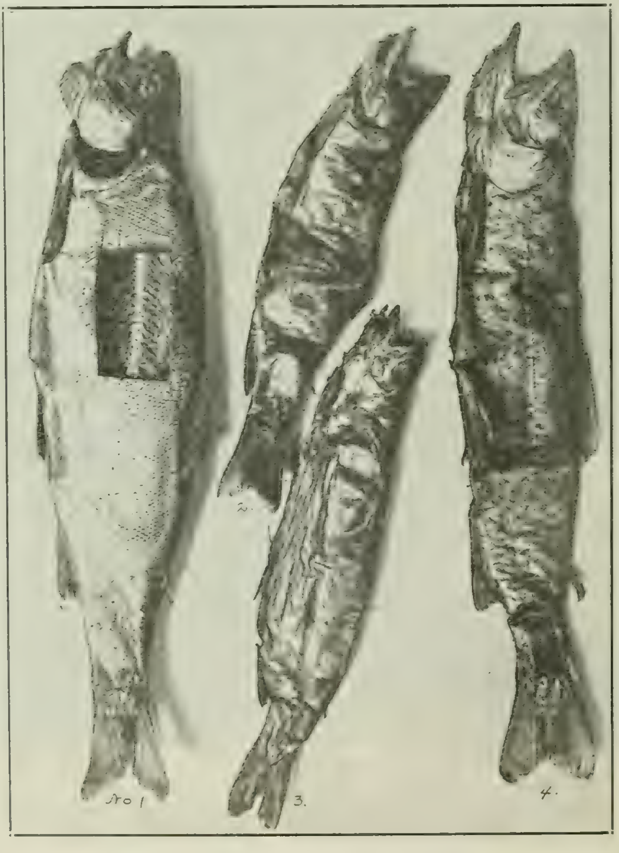


FIG. 6. Specimens of rainbow, Tahoe cutthroat, eastern brook and golden trout, suitably preserved for identification.

eviscerated and hung up in the shade. Yellowjackets finished the job, leaving a perfect skin, nicely prepared skeleton, teeth, gillrakers and all, even the cornea of the eye. In all cases the dark pigment of the skin was perfectly preserved, the spots being as plain as in life, and much of the delicate golden tint and the silvery sheen were evident.

Professor Brown relates that when an unusually ambitious yellowjacket began to gnaw some vital part like the skin along the edge of a cut, or a natural opening of the body, all that was necessary to stop him was the application of a bit of vaseline, not to the bee of course, but to the part that was being eaten.

In the photograph here presented, one is able to recognize the rainbow (No. 1) and the Tahoe cutthroat (4). The skins of the brook trout (2), and also the golden trout (3), were equally well preserved, but the plate was not sensitive to their delicate colors. The incision in the skin of the rainbow permits a section of the nicely cleaned skeleton to be seen. A light spray of an alcoholic solution of corrosive sublimate applied in the laboratory, will protect the specimens from the ravages of insects, and there seems to be no reason why they should not be kept for years.

The rainbow trout was taken in Babcock and Emeric lakes, and also in Fletcher Creek, the brook trout was found in Babcock Lake, the cutthroat came from Emeric Lake and Fletcher Creek, while the golden trout was caught in Fletcher Lake and the creek of the same name. Fishing was reported good, there being an abundance of trout in these lakes and streams. The fish were all introduced, none being natives of the basin which is in the midst of the mountains not far to the eastward of Yosemite Valley.

CALIFORNIA'S LARGE GAME ANIMALS.

By M. Hall McAllister.

Under the leadership of the California Academy of Sciences and in cooperation with several Eastern societies a united effort is now being made to regularly care for the various remnants of the great herds of large mammals that formerly ranged over the great West and the states of California, Nevada and Oregon.

A fund is being gotten together by the following subscribers:

The American Bison Society of New York.
New York Zoological Society Wild Life Fund.
California Fish and Game Commission.
United States Forest Service.
California Academy of Sciences.

This money will be handled by a regular committee of the Academy and will be expended for the purposes of winter feed for the herds; salaries of gamekeepers; expenses of forming refugees, and general supervision and observation.

To give an idea of what has already been done in large game conservation and preservation the following will give the details.

Buffalo—One hundred years ago these animals ranged over practically the whole of North America from the Appalachian regions in the

East to the Rocky Mountains in the West, and from Canada's muskeg swamps to Mexico's northern plains.

From 1860 to 1870 the herds were estimated:

Great southern herd	3,500,000
Great northern herd	1,500,000
Total	5,000,000

Say a total of five million animals.

In those days on the western plains these mighty hosts of buffaloes frequently stopped or derailed railroad trains and even obstructed the passage of small river boats on the upper waters of the Missouri and Yellowstone rivers.

In 1869 the Union Pacific Railroad was completed and in about ten years this greatest herd of one species of animal on the globe was completely annihilated. The southern herd on the line of the Union Pacific was first to go; it was savagely attacked by the skin hunters and by 1875, with the exception of three small bunches had all been killed. In 1880 the Northern Pacific was completed and a similar attack was then made on the northern herd and by the end of 1883 they were all slaughtered leaving only the Yellowstone Park herd, which was supposed to number from 100 to 200 head, and a small protected band of 40 in Custer County, Montana.

During 1890 the Yellowstone herd was attacked in the winter by poachers and reduced, some say as low as only twelve, while other estimates were between 20 and 30 head.

Theodore Roosevelt was a plainsman and saw the remnants of the northern herd in Dakota in the early 80's. In his volume "Hunting Trips of a Ranchman" he tells the story of the extermination of the buffalo and shows the head of a bison bull shot by himself in 1883. Roosevelt's brother Elliott Roosevelt, was also quite a buffalo hunter and was in at the death of the great southern herd in 1877.

Roosevelt writes: "It may truthfully be said that the sudden and complete extermination of the vast herds of buffalo is without a parallel in historic times."

There are hundreds of stories of buffalo hunts and hunting, but one of the best was written by General Lew Wallace, author of Ben Hur. He tells of a hunt on the plains of Northern Mexico in 1867. It is a remarkable description in the fact that it is one of the few authentic accounts showing how far south the buffalo migrated. This herd of several hundred animals was found about 300 miles south of the Rio Grande River, in the State of Durango, while General Wallace was making a horseback trip from Monterey and Saltillo across the Coahuila plains to the City of Chihuahua, this journey being approximately along the 26th degree of north latitude. It is, so far as known, the most southerly record of the migrations of the buffalo.

The great English sportsman Sir Samuel Baker visited America in 1881 and writes as follows: "The American bison is a grand looking creature and in my opinion it is the most striking of all wild animals; there is a peculiar savagery in the aspect of a shaggy old bull in its winter coat which surpasses in wildness of appearance all other species of game."

To show what a true sportsman this splendid Englishman was, we quote regarding a buffalo hunt in the year 1881:

"As the bullet struck within a couple of inches of the mark, this magnificent bull plunged heavily to the ground. The three remaining buffalo, all bulls, dashed through the shallow stream, and struggled up the opposing bank. I immediately reloaded and took a lovely aim between the shoulders of each bull, as it exposed itself to a deadly shot which was almost perpendicular within 70 or 80 yards; but I would not fire; I had them completely in my power and that was sufficient. Buffaloes were being destroyed wholesale, and I would not join in the brutal list of destroyers."

He then tells how he stalked from 30 to 40 of these splendid animals which he could have shot with ease, leaving them to rot on the plains, till finally his cowboy guide said: "Well, if you came all the way from the old country to shoot, and you won't shoot when you get the chance, you'd have done better to stop at home." Sir Samuel also did the same with elk and antelope after bagging his first specimens.

He writes further: "The buffaloes on many occasions fed around our camp within 300 or 400 yards. We could watch them with our binoculars and we enjoyed the study of their ways with far greater pleasure than I should have felt in shooting them."

An old time volume "Buffalo Land" published in 1872, describes the trip of a party of New York gentlemen hunters who spent the summer of 1870 in the great West and saw a lot of the destruction which went on. They recite: "During the year 1871, about 50,000 buffalo were killed on the plains of Kansas and Colorado alone. Of this number, it will be correct to estimate that about one-third were shot for their robes, as many more for meat and some 16,000 slaughtered in the name of so-called sport. This book has a series of pictures showing the various modes of slaughter, the titles being:

300 buffaloes a day for pleasure. Sportsmen on horses.
100,000 buffaloes a day for their tongues by Indians.
200,000 buffaloes a day for their robes to get whiskey by the Indians.
Daily for fun; showing shooting into herds from the railroad cars.
Daily for excitement; showing shooting while the herds are crossing the rivers.

The principal hunters and guides all seemed to have the name of Bill tacked on; their guides were Wild Bill (William Hickox); Buffalo Bill (the celebrated William F. Cody), and there was also California Bill, Rattlesnake Bill, and Tiger Bill, and they also heard of Comanche Bill and Apache Bill. But Tiger Bill had the reputation of being the "dangerest on 'em all."

The late C. Jesse Jones, known every where as "Buffalo Jones" in the 70's, did one act which saved at least one bunch from extermination. He and his cowboys roped from the great southern herd a dozen young calves, six bulls and six heifers, and took them in safety to his ranch in Kansas. Also Colonel Charles Goodnight, of Goodnight, Texas, rounded up and saved a bunch of young stock from the same great herd.

As to the size and weight of a full-grown buffalo, Dr. Hornaday of the Bronx Zoo, who is the greatest living authority, bagged a bull in 1886 in Montana which weighed 2100 pounds. This animal is now in the National Museum in Washington. This was the record until the large bull "Black Dog" which was bred on the government farm at Wichita, Kansas, turned the scale at 2800 pounds.

In the year 1900 the American Bison Society was formed in New York, the object being to endeavor to save this splendid species from total and entire extinction. The personnel comprised the following philanthropic men: Austin Corbin, James J. Hill, W. C. Whitney, Col. Goodnight of Texas, C. Jesse Jones (Buffalo Jones), Colonel W. F. Cody (Buffalo Bill), E. J. Molera of San Francisco, and a number of others.

Their efforts together with the active cooperation of their successors have met with complete success. On the first of January, 1923, just passed, there were in excess of ten thousand (10,000) head of buffalo in the United States and Canada.

The original score, some twenty years ago, was exactly 34 wild buffalo beside several hundred which ranged as a separate herd in the muskeg swamps of Canada near the Great Slave Lake; also several hundred tame bison on the various ranches and in parks.

The first real census of tame and wild bison in 1903 showed a total of 1753 head which in the year 1920 had increased to 8473 head and today the total is well over 10,000 animals.

The United States government has several fine herds, those of Yellowstone Park and Wichita, Kansas, being the largest and best. The Yellowstone herd has 100 wild and 500 tame bison, a total of 600 being the latest report. Of the grand total of 10,000 head, the Canadian government has about 6000 and the United States and private herds the remaining 4000 buffalo.

The Canadians are now starting to market their surplus by the sale of buffalo robes, the meat, and stuffed or mounted heads. They sent ten mounted heads to the last annual "Fur-sale" at St. Louis, where they sold for from $350 to $1,250 each.

Reindeer—The most remarkable conservation and increase of animal life has been that of the reindeer in Alaska. In 1892, just 30 years ago, Dr. Sheldon Jackson brought over the first installment from European Russia, which was followed by the United States government shipments from Siberia. A total of some 1280 animals was imported during the ten years from 1892 to 1902. The increases since that time have been phenomenal as up to January, 1922, a census shows nearly 250,000 animals distributed as follows:

Natives	162,000
Government herds	12,000
Mission herds	24,000
Others	52,000
Total	250,000

Reindeer meat is now on sale in most of the large cities in the states but does not fulfill the demand expected of same. The white man's palate has been so long used to his regular civilized meats, beef, mutton and pork, that reindeer steak or cutlets are considered as a novelty and not as a regular diet. There is some question as to its success as a seller in the United States proper. It is, however, a great boon and really an act of Providence to the Alaskan native, giving him food, and clothing without the former dangers and uncertainties of his former food supply of seal and walrus.

California Valley Elk—Before the white man arrived in California our great valleys were teeming with all varieties of game; both mammals and bird life existed in untold numbers. In an effort to keep before us some of these beautiful creatures the California Academy of Sciences with the aid of other agencies has considered the proposition of establishing game refuges in favorable localities.

The first unit has been established in the Yosemite Valley under the control and care of the National Park Service and consists of some thirty acres on the floor of the valley near the Sentinel Hotel alongside of the clear flowing Merced River and just in front of the new Rangers Club House. This is a large fenced enclosure which will be the central unit for the care and propagation of the California valley elk. This paddock will be considered as the parent or base for the breeding and distribution of the species which differs so much from the Roosevelt or mountain elk that they will not inter-breed.

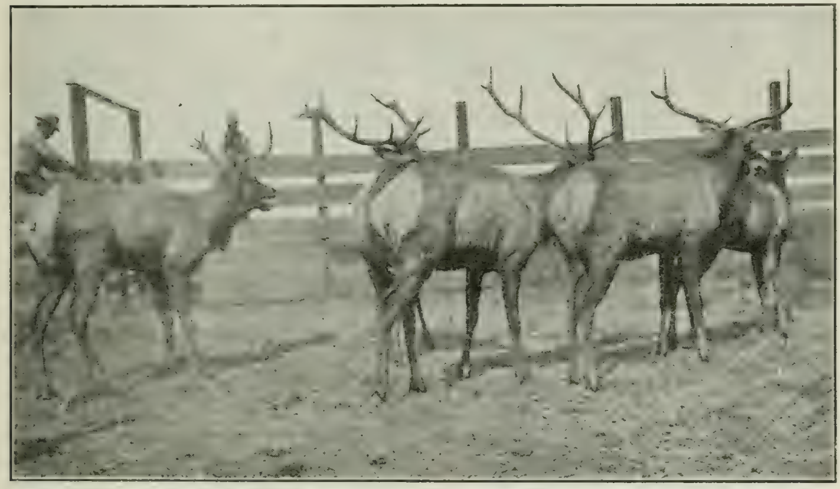


FIG. 7. California valley elk in corral at Buttonwillow, Kern County, ready for shipment, by California Academy of Sciences. Photograph by John Rowley.

The original herd for this paddock came from the Miller and Lux ranch at Buttonwillow, Kern County, where at one time there was a total of 400 head. Several round-ups or rodeos have taken place and the actual count made September, 1921, showed nearer 350 head to be correct. Four catches have been made:

About 1910	Biological Survey	10 animals
1914	California Academy of Sciences	54 animals
1915	California Academy of Sciences	92 animals
1921	California Academy of Sciences	10 animals
	Total	166

The above animals which were caught up and distributed have about held their own. The natural increase has about offset the losses.

The herd in the Yosemite will be kept as a base which can be fostered and cared for so this most interesting variety of the American elk, which all sportsmen and collectors call "The king of the Cervidæ," will always remain with us.

THE BLACK BEAR IN RELATION TO STOCK.

By JAY BRUCE, State Lion Hunter.

An effort is being made by the stockmen of California to repeal the law protecting the black bear (*Ursus americanus*). The complaint against the bear is based on the allegation that he is destructive to stock.

I have no doubt that most of these men sincerely believe that the bear does kill stock, but I am convinced by my own experience that these men are being misled by appearance and misinformation.

I myself have hunted since I was 10 years old and have traveled on foot more than 30,000 miles over the mountains of California, hunting and trailing different kinds of game. About 1500 miles of the distance has been covered while hunting mountain lions. For several years before I was employed to hunt lions for the California Fish and Game Commission, I made a business of conducting deer hunting and fishing parties during the open season, and hunting bear, lion and bobcats during the fall and winter. At that time I found the average bear to be worth about $50, including meat, hide and the lard, which was used by my family. The same bear, if killed during the summer, would not be worth anything for any purpose.

During my many years of sportsmanship I have bagged 42 bear, 155 mountain lion, and 209 bobcats. When I entered the employ of the Fish and Game Commission on January 1, 1919, I immediately began breaking my dog from running bear, and specialized on hunting lions. Nearly all of my hunting was done when bear were from five to ten times as numerous as lions and on account of using thoroughly trained lion dogs I have had many unusually favorable opportunities to correctly check up on reports where bear were accused of killing stock. Every such report I have investigated I have found the bear to be innocent of the killing. However, I can easily realize why the average stock man gains the impression that the bear kills his stock, for while hunting bear and lion I have found hundreds of carcasses of deer and domestic stock that were killed by mountain lion and eaten by bears. The lion seeks out the bedding grounds of sheep during the night and slays several sheep in a few minutes, or he lies in the brush on the range and kills sheep during the day, in either case eating only the liver and part of the hams, leaving the balance to decay. The bear, which is a natural scavenger, is attracted to the range by the odor of the decaying carcasses and stays there, living on the kills left by the lion. The sheep destroy the lion tracks on the range, so when, on account of the odor, the herder finds the sheep carcass, the bear has already been there and trampled the ground around the kills. Then the bear is accused of making the kills.

One example of the kind was last October, while on my way into Big Squaw Creek in Shasta County, when I met a sheep man from Dunsmuir, who was driving his sheep out of the mountains for the winter. When I asked this man if his sheep had been bothered by lion during the summer, he answered that they had not, but that he had lost about a hundred sheep by bears. When I suggested that the sheep had probably been killed by lions, he very emphatically stated that they had not, as there had not been any lion or lion signs on his range at any time during the summer, but that bear signs were numerous. He said, "I know it was bear's work for I know the work of bears and could not be mistaken." On the strength of this information, I immediately went onto this man's sheep range which he had just left, and bagged ten lions during nine days of hunting, and about the same time a man by the name of Morgan bagged five lions just off the western edge of the same range. Every one of these fifteen lions could have been living on sheep all summer and probably were doing so, at least part of the time.

Another example of this kind was the case of Charles Ralph, who was raising goats in Tuolumne County. Ralph had lost 300 goats one year, and he told me that there were five lions and several bears killing his goats. I bagged one large male lion on the first day, and found the lion's stomach contained goat meat. Saw signs of several bears on the range but found no more lion signs during five days of hunting. A year and a half later, Ralph wrote to me, stating that he had not lost any more goats nor seen any more lion signs. After the lion was killed, the goats were not molested. This one lion had apparently destroyed 300 goats in one year, and several bear had been living on the kills after they were abandoned by the lion. Naturally the bear was blamed for part of the damage.

While I was hunting lions in El Dorado County last August, in company with Mr. Frank Newbert, we were informed two lions had killed one hundred sheep within twenty-five days, at the head of Alder Creek. Mr. Newbert and I arrived at this range about two days after the sheep had been moved out, but a cattle man by the name of Johnson took us to where one lion had killed a sheep about three days before. We could plainly see by the tracks that the lion had killed the sheep and dragged it for about a half mile and hidden it in a thicket of fir saplings. We found the remains of several sheep near this thicket and all of them had been devoured by bears, only the hide and bones remaining. We trailed this lion, which was a very large male, for about a mile and then found the fresh track of a lioness, which we followed until two o'clock in the afternoon when we found where the carcass of a sheep had been dragged across a flat; we then followed the drag for about two hundred feet and found the kill in a thicket of fir trees. This sheep had apparently been killed about nine o'clock the evening before and two bears had already found the carcass, devoured part of it and then bedded down near by, leaving only when they heard the hound baying on the lion trail. The bears had destroyed the lion tracks and scent around the carcass, and it was necessary to circle at a distance of a hundred feet to again find the lion tracks, which we followed unsuccessfully until dark. Early the next morning we returned to the kill in order to get her fresh tracks, if the lioness had returned to the kill. The lioness had not returned but two bears had been there and devoured the remains of the sheep. I called Mr. Newbert's attention to the fact that all the evidence around the kill had indicated that the bear had killed the sheep. We then back-tracked the drag for about three hundred feet to the place where the sheep was killed. Then we could plainly see the tracks made by the lioness when she rushed over and struck down the sheep, thus proving the lioness the slayer. This lioness had apparently killed this strong sheep about 9 o'clock in the evening, dragged it to cover, taken a feed, and then left the place with no intention of returning for another feed, for I tracked her for three days and killed her twenty-five miles from this place. During the next few days I tracked the male lion around his beat, which at one place was twenty-five miles from the sheep range. When I killed him he had almost reached the sheep range again.

A lion travels a definite beat over about one hundred square miles, usually making his rounds every four or five days; when the summer sheep range or run in its beat at any place, the lion may kill several sheep within a few minutes some time during the night, take one feed and then continue on around his beat, make a kill or two at some other point and not return to the range for several days; in the meantime, the bear is attracted to the range, where he stays, living on the sheep carcass left by the lion. Fresh bear signs are seen every day on the range and around the carcass and it is not surprising that the bear is blamed for the damage done by the lion.

In every instance that I have personally investigated where bear have been accused of killing stock, I have found the slayer to be a lion, except in a few cases where coyotes were responsible. In fact, I have never known a bear to actually kill any large animal, either wild or domestic.

The mountain lion is a strictly carnivorous animal and in his natural state demands meat freshly killed by himself. In the summer a carcass will quickly taint and in winter it will freeze; for these reasons the lion will make a fresh kill for his feed wherever possible. On the other hand, the black bear is not by nature a killer for he does not need to depend on this method for a living. While he will travel a long way to eat putrid meat, still he can get plenty without it. His food list is a long one, consisting of acorns, fruit, berries, mint, ants, yellow jackets, roots, grass and wild clover, all of which I have personally known wild bear to eat.

In my opinion the black bear is a splendid game animal, valuable for meat, lard and fur when killed in the fall or winter. I do not believe that he can be considered a menace to stock or game, but that he has been wrongly accused on general appearance for the damage done by mountain lions and coyotes, and that the complaints largely made by people who had no reliable method of investigating the circumstances, or had neglected to do so, assuming that bear signs around the carcass of stock were conclusive evidence that the bear were responsible for the loss of the stock.

SALMON FISHCULTURAL OPERATIONS ON THE KLAMATH RIVER.

By Harold C. Bryant.

Most of the salmon cultural operations of the California Fish and Game Commission are now centered on the Klamath River, the only remaining stream with a good run of salmon. It may also be explained that this same river furnishes most of the trout eggs utilized at the hatcheries, there being four egg-collecting stations on tributaries of this stream. Change from the Sacramento to the Klamath River has been necessitated because of the poor take of eggs in recent years at the United States Bureau of Fisheries' egg-collecting stations at Mill Creek and Baird, and because of a growing desire of the state to be independent of government aid. A depleted run of salmon, plus the barrier formed by the Redding Dam, have apparently been responsible for the decreasing supply of eggs on the Sacramento.

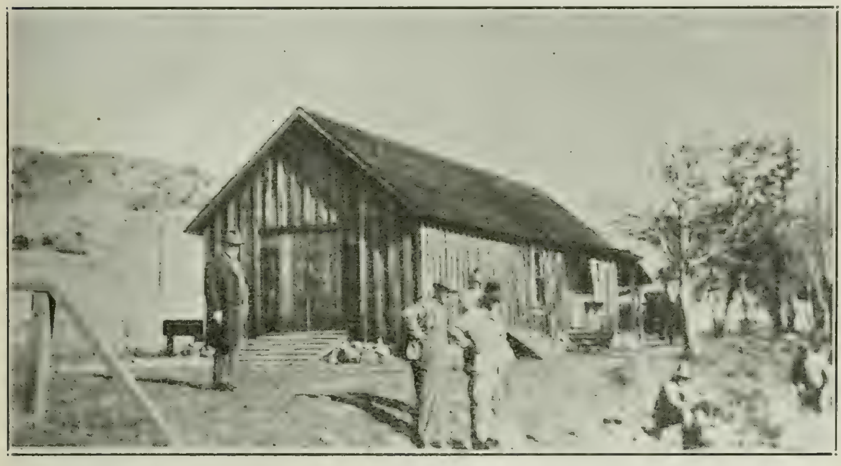


Fig. 8. Klamathon salmon spawning station. Photograph by A. S. Cheney.

Until 1918, the Commission depended almost wholly upon the United States Bureau of Fisheries for its supply of salmon eggs. This arrangement was satisfactory for many years, as an abundant supply of eggs was available from the Sacramento River stations. Fifteen to twenty millions of eggs were donated by the bureau annually. Relations have been most cordial, the federal and state bureaus working in complete harmony. Nevertheless, the Commission desiring to be wholly independent, beginning in 1918, took over the former Bureau of Fisheries' egg-collecting station at Klamathon, Siskiyou County, and since that time this station has supplied most of the eggs utilized by the state. Splendid results were to be expected for spawning operations at this point for many years previous had demonstrated the suitability of the location.

In accordance with the provisions of the law, which requires owners of dams to erect hatcheries in lieu of fishways, when dams are too high for the successful operation of a fishway, the California-Oregon Power Company, owners of the Copco dam, were required to build and equip a hatchery at Fall Creek, and to build racks and an egg-collecting station for salmon at Klamathon. This equipment cost the company about $20,000. This spawn-taking station and hatchery now form the nucleus for most of the salmon cultural operations. The racks are well built and the resulting take of salmon is very satisfactory.

The station is operated during late September and October, a crew of five or six men being necessary. Salmon are seined from the river between the racks and are placed in holding tanks pending spawning operations. In spawning trout the eggs are stripped from the female and the fish is returned to the stream, but in spawning salmon, the fish is first killed and then cut open and the eggs secured. This is possible in that the fish habitually die after spawning. Being still useful for food, the spawned salmon are given to residents, who are glad to smoke or cure them. In some states these spawned salmon are dried and utilized as fish food at the state hatcheries.

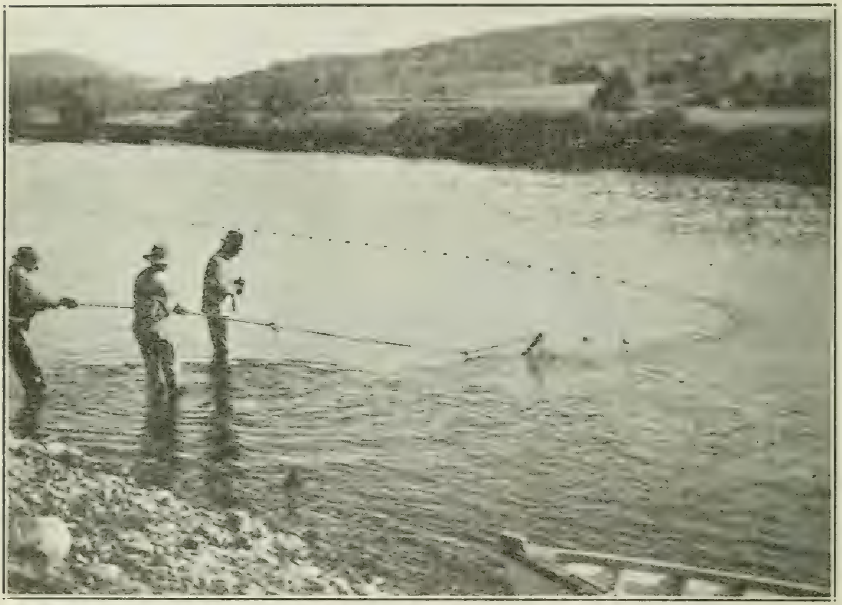


FIG. 9. Seining for salmon at the Klamathon spawning station, November 13, 1922. Photograph by A. S. Cheney.

Investigations by the Commission have shown the average yield of the Klamath River king salmon to be 3891 eggs, the larger fish furnishing five to eight thousand eggs, and the smaller ones two to five thousand eggs. The yield of eggs in the Sacramento salmon appears to be greater. To secure the twenty millions of salmon eggs taken during the 1922 season, it was therefore necessary to catch over 5200 ripe female salmon and as many males. Since many fish reaching the racks are not ready to spawn the number needed for a successful spawning season is very much greater. Many silver salmon are caught in the traps but it is the larger king salmon that is selected.

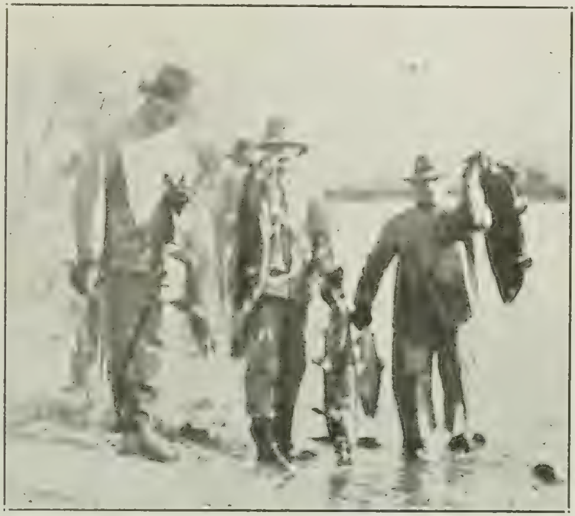


FIG. 10. King salmon taken at the Klamathon egg-collecting station, November 13, 1922. Photograph by H. C. Bryant.

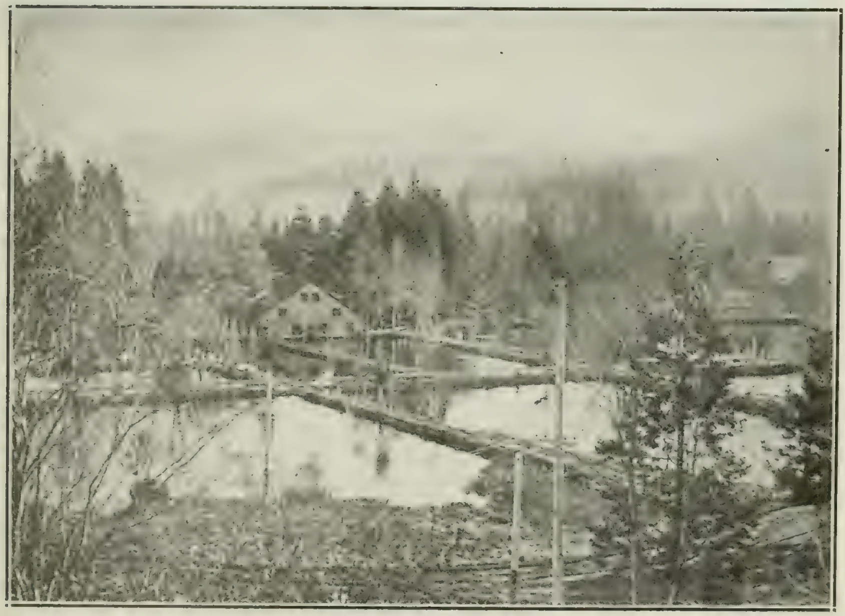


FIG. 11. Rearing ponds at the Mt. Shasta Hatchery. Photograph by H. C. Bryant.

Large numbers of Klamath River trout are trapped along with the salmon and these are netted from the traps and allowed to continue their way up stream. Doubtless some of these same fish are spawned the following spring at Fall Creek, Bogus and Camp Creek egg-collecting stations.

The salmon eggs are immediately shipped in cans to the Mount Shasta Hatchery or to the Fall Creek Hatchery. Later, some eggs are shipped to the Fort Seward Hatchery. Two of the largest hatching houses are devoted to salmon culture at Sisson. Here the eggs are hatched and the fry held in rearing ponds. After the fry reach the fingerling stage and fall freshets come, the rearing ponds are opened and the fish allowed to enter the Klamath River, in the case of Fall Creek Hatchery, and the Sacramento River in the case of the Mount Shasta Hatchery. This simple method of planting is coming to be recognized as the best method possible.

FIG. 12. King salmon spawning on a gravel bar in the Klamath River.

Beginning in 1914, the pond system for rearing salmon to the fingerling stage was instituted in order that larger, stronger fish might be liberated. This method of handling salmon fry gives them a chance to reach the ocean without falling prey to the predatory fishes in the lower reaches of the rivers because of their better development. Two small lakes near the Mount Shasta Hatchery are rented and used as rearing ponds. Equipment now allows the holding of 20,000,000 salmon fry in nursery ponds and lakes until cold weather in the fall, when a draining of the ponds and lakes allows them to enter naturally and without any shock, their native stream. Before being removed to nursery ponds the fry are held and fed in troughs about two months. In the ponds the fry attain a remarkable growth, sometimes reaching six or eight inches in length and usually averaging four to five inches.

The California Fish and Game Commission may justly lay claim to part of the honor of giving to the world the main facts regarding the life history and habits of the king salmon, for Cloudsley Rutter, while working for the Commission in cooperation with the Bureau of Fisheries, worked out and published the first complete account of the natural history of the quinnat or king salmon (U. S. Bureau Fisheries, Bull. 22, pp. 65-141). Now the commission is winning new honors as the result of marking experiments under the direction of Professor J. O. Snyder, of Stanford University. During the trapping operations in October, 1922, several of the fish that were marked four years ago were taken. The study of these salmon furnishes important evidence as to the age, rate of growth and distribution. The opportunity offered as a result of the trapping operations was thus properly utilized.

It is to be hoped that this increasing knowledge of the life history and habits may be instrumental in helping to solve the numerous problems confronting salmon conservationists. The present situation is such that many take the pessimistic view that salmon must eventually disappear, owing to the numerous power projects which obstruct the upstream migrations.

From a fishcultural standpoint. the situation is favorable, for hatchery problems are largely solved, but there remains the more critical one of barriers to natural increase.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to **H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.**

MARCH 12, 1923.

"To maintain the game supply, and at the same time to provide, if possible, fair sport for the increasing number of hunters that may confidently be expected, is one task before us."—Edward A. Goldman.

A NEW COMMISSIONER.

Announcement was made on December 12th of the appointment by Governor Wm. D. Stephens of Geo. H. Anderson as fish and game commissioner to succeed E. L. Bosqui.

Mr. Anderson is a business man of San Jose who has long been interested in fish and game conservation. When state senator, in 1901, he fathered bills for the nonsale of game. He is an ardent sportsman and angler and noted as a trap shooter.

Mr. Anderson's statement to the press follows:

Geo. H. Anderson, newly appointed fish and game commissioner.

Having been asked by numerous sportsmen what policy I would pursue on my entrance to the Fish and Game Commission, I want to say that I heartily indorse the policy of the present Commission as to game protection and propagation of fish, and feel that it has made a wonderful record.

I am for laws that will benefit the largest number of sportsmen and protect the game. I am also in favor of the present Federal tax bill, which has already passed the United States Senate. The Federal Government has done an immense amount of good in the protection of our wild ducks, especially in the Alaska region, and will need money to further pursue the good work it has started.

I believe in the nonsale of game, and claim that more people are now enjoying wild ducks through the courtesy of friends than before the nonsale law went into effect. With the advent of the automobile we have dozens of hunters and fishermen where we had one a few years ago, and it is up to the Commission to raise and distribute fish and protect the game to the fullest extent.

In this respect will say that the present Commission has made wonderful strides, and in entering this Commission I am joining two of the most enthusiastic and thorough sportsmen in California (Messrs. Newbert and Connell). Besides being competent, they are thoroughly honest in spending the money of the sportsmen of the state, and I hope I will be able to make as fine a record as these gentlemen have. I will surely try my best.

Permit me to thank my numerous friends for a large number of congratulatory letters and telegrams on my appointment.

1922 BIENNIAL REPORT.

The biennial report of the Fish and Game Commission will soon be available to those interested. It chronicles the outstanding features of the work during the past two fiscal years, and calls attention to many problems needing solution.

Arrests for violations of the game laws totaled 1221. Of this number 1108 resulted in convictions. The fines collected amounted to $33,998.80, in addition to 1289 days of imprisonment awarded. Arrests for violations of state fish laws totaled 1037, from which there were 983 convictions. Fines collected amounted to $29,028.50 and offenders were awarded a total of 994 days of imprisonment. The total number of arrests amounted to 2258, nearly 400 more than reported in 1920.

During the biennium a large amount of illegally taken fish and game was seized. The totals are of interest: Over two tons of deer meat; 4500 ducks and 500 quail; 25 tons of fish, and about 12 tons of lobsters and shellfish. All wholesome fish and game was donated to public and charitable institutions and many grateful letters of acknowledgment have been received. Considerable illegally used fishing apparatus, which was seized after being condemned in superior court, has been destroyed or sold by the board in accordance with law.

The total output of trout amounted to 40,974,000 and of salmon fry 18,037,000. The pond system established at the Mount Shasta Hatchery now furnishes an annual take of 10,000,000 eggs. Not only is this supply of eggs more dependable but the expense of securing them is much less. The fishcultural department's recommendations include enlargement of the pond system, the building of more hatcheries, the introduction of certain insect food for fishes, the establishment of a fish reserve on the Klamath River, and certain changes in the laws relating to game fish.

The Commercial Fisheries Department reports on interesting salmon marking experiments carried on to determine the age, rate of growth and distribution of the king salmon and on the fisheries investigations undertaken by the State Fisheries Laboratory.

Educational work has included lectures in the public schools, the issuance of many bulletins, and the development of instruction in natural history in the summer resorts.

Under the head of current problems such subjects as the following are discussed: the alien hunter, power dams endanger salmon run, demand for trout fry exceeds supply, grazing endangers feed conditions in game refuges, winter feeding of game, and careless hunters.

Reports of the district officers are given and the appendix contains statistical reports showing that 225,000 hunting licenses and 186,000 angling licenses are issued annually; that the fisheries of the state annually supply 20,500 tons of fish, and that 256 bounties were paid on mountain lions during 1921.

The report brings convincing evidence of the great value of the state's game resources and the extent of the conservation measures taken to conserve them.

WESTERN ASSOCIATION OF FISH AND GAME COMMISSIONERS MEETS AT SACRAMENTO.

The second annual meeting of the Western Association of Fish and Game Commissioners was held at Sacramento, December 4 and 5, 1922. President D. H. Madsen of Utah presided, and the following members were present: Hon. Chas. A. Jakways, Montana; Hon. O. M. Jones, Idaho; Hon. R. G. Parvin, Colorado; Hon. L. E. Bean, Oregon; and Hon. F. M. Newbert, California. Geo. A. Lawyer, United States Game Warden, two representatives of the United States Forest Service, one of the National Park Service and others interested were in attendance.

The first day was devoted to a discussion of methods of fishculture. The use of nursery ponds to care for the fry when first planted in the mountain streams was discussed at length, as was also the destructiveness to young trout by the great blue heron, merganser, pelican and grebe. The consensus of opinion was to the effect that these birds are so destructive to young trout that they should be removed from the protected list and means taken to reduce their numbers. It was decided that in fish propagation one fish three inches long is equal to fifty small fry planted in the stream, because of its greater ability to escape enemies. Attention was called to the poor success obtained by purchasing eastern brook trout eggs from private hatcheries since most of the eggs come from two-year-old fish and the embryos are weak. Time was also given to a discussion of the screening of irrigation ditches and of the construction of fishways. Heads of departments of the California Commission gave reports on their work.

A heated discussion on the Public Shooting Grounds-Game Refuge Bill then took place. A majority of the members expressed themselves as against further enroachment of the government in the administration of fish and game. Mr. Geo. A. Lawyer, United States Game Warden, and Hon. F. M. Newbert, president of the California Fish and Game Commission, defended the measure. Two important points made by the opposition were the duplication of the warden work in that federal wardens will be able to make cases with reference to migratory birds only, and the difficulty to be expected in collecting a dollar license in those states where the license fees have already been raised to two and three dollars.

At the closing session the following resolutions having received the endorsement of the resolutions committee were passed unanimously by the association, with the following exception: A minority report on the proposed "Public Shooting Ground and Game Refuge Bill" was filed by the resolutions committee, and upon vote by the association the states of Oregon, Utah, Idaho and Colorado voted for the adoption of the majority report, and the states of California and Montana voted in favor of the adoption of the minority report. The majority report of the resolutions committee, having received a majority vote of all the delegates present, was declared adopted. Both the majority and minority reports were spread on the minutes of the association as follows:

Majority Report.

To the officers and members of the Western Association of Game Commissioners:

GENTLEMEN:

We, your Committee on Resolutions, to whom was referred the matter of the proposed "Public Shooting Ground and Game Refuge Bill," designated as H. R. 5823 and S. B. 1452, beg leave to report that we have had this matter under careful consideration, and after weighing all of the arguments presented for and against said measures, submit the following resolution as expressing the views of the western states thereon:

Resolved, That the Western Association of State Game Commissioners at its regular annual conference, assembled at Sacramento, California, on this fifth day of December, 1922, do hereby reaffirm the action of our association as expressed in resolutions adopted at our annual conference held at Salt Lake City, Utah, on the sixteenth and seventeenth days of January, 1922, and, be it further

Resolved, That we are unalterably opposed to the measures referred to, and assign the further reasons for our actions, to wit:

First—There is no crying need for either public shooting grounds or bird refuges in the northwest, nor is such a need apt to become acute for the next ten years. It is the contention of these states that when a condition does arise that needs supervision, that they are capable of taking care of any such situations within themselves. Consequently any immediate service that might result from such a measure would be directed to the districts demanding that service to relieve conditions already existing. These districts are the eastern states.

Second—Already the west is tired of being dictated to as to its operations and its control of natural resources by Fifth avenue, New York, and Pennsylvania avenue, Washington, D. C. The constituents of the game departments of the northwest will hold their respective representatives assembled here to a strict accounting of what they do or recommend at this time in reference to this bill. A large percentage of these people do not know there is such a bill before Congress today, and if they did know the provisions of this bill, particularly that provision demanding an additional license, there would be a general uprising of protest against this measure.

And, further, That this class of legislation is not only not for the best interests of the several states, but is contrary to and clearly a violation of the sovereign rights of the states.

L. E. BEAN.
OTTO M. JONES.

Minority Report.

To the officers and members of the Western Association of Game Commissioners:

GENTLEMEN:

As a member of the committee of resolutions of the Western Association of State Game Commissioners, I offer for consideration the following minority resolution:

WHEREAS, There is before the National Congress a measure known as the "Public Shooting Ground and Game Refuge Bill," which is herein designated as H. R. 5823; and

WHEREAS, The Association of Western States Game Commissioners in session at Salt Lake City, Utah, January 16 and 17, 1922, passed resolutions objecting to the passage of said H. R. 5823 for the reason that in the opinion of the Commissioners there present, the bill as then proposed would have curtailed the jurisdiction of the various states over their local wild life; and

WHEREAS, Certain amendments have been introduced by Congressman Anthony as follows:

Amendment to H. R. 5823 (Original Bill).

On page 7, line 9, strike out "fish, wild animal, or" and insert "migratory."

On page 7, lines 21 and 22, strike out "fish, wild animal, or wild," and insert in lieu thereof "migratory."

Amendment to Section 3.

Provided that nothing in this act shall be construed to exempt any person from complying with the provisions of the laws of the several states.

Amendment to Section 13.

(Agreed upon to placate fish interests) or except for the purpose of fishing, in conformity with the laws of the state wherein the public shooting ground or bird or game refuge so entered may be located, when conducted at such times and in such manner as will not interfere with the maintenance of such areas as migratory bird breeding grounds.

Amendment to Section 4.

(As originally written, to be submitted by Congressman Anthony on the floor of the House for section 4 as amended by the House Committee.)

Provided, That any part of the 45 per centum last mentioned or of the 10 per centum of such moneys received in any fiscal year and remaining unexpended and against which there are no liabilities at the expiration of two years from the end of such fiscal year, shall revert to the surplus fund of the treasury. The Secretary of Agriculture shall make an annual report to Congress of receipts and expenditures under this act.

Section 17.

That if any clause, sentence, paragraph or part of this act shall, for any reason, be adjudged by any court of competent jurisdiction to be invalid, such judgment shall not affect, impair or invalidate the remainder thereof, but shall be confined in its operation to the clause, sentence, paragraph, or part thereof directly involved in the controversy in which such judgment shall have been rendered. And

WHEREAS, The Association of Western States Game Commissioners in session assembled at Sacramento, California, this fifth day of December, 1922, believe the fundamental principal of H. R. 5823 to be good; therefore, be it

Resolved, That when the aforesaid amendments have been passed and made a part of H. R. 5823, we approve and urge the immediate passage of the measure; and, further be it

Resolved, That we reserve our commendation of any other amendments or changes in H. R. 5823 until said changes can be considered by our association, and

It is ordered that a copy of these resolutions be furnished our several representatives and senators in congress, and that the same be spread upon the minutes of this meeting.

C. A. JAKWAYS.

Done at Sacramento this fifth day of December, 1922.

Resolutions.

WHEREAS, The Association of Western States Game Commissioners in second annual convention assembled at Sacramento, California, December 4 and 5, 1922, has received every evidence of the highly efficient manner our present hosts, the California Fish and Game Commission, has administered the laws for the conservation of fish and game in California, and has enjoyed to the limit the typically southern hospitality for which the "Golden State" is famous; now, therefore, be it

Resolved, That this association tender to Mr. Frank M. Newbert, president of the California Fish and Game Commission, and his associates, our hearty personal appreciation of the innumerable pleasant courtesies we have enjoyed at their hands, and our official recognition of the splendid precedents established and examples set in wild life work in California which might well be emulated by other states.

WHEREAS, It has been found that certain migratory birds are of no economic value in some states and are predatory in those states and whereas these same birds are beneficial in other states; therefore, be it

Resolved, That we believe the destruction or protection of these birds be worked out between the several states and The Bureau of the Biological Survey.

WHEREAS, It has come to our notice that game, fur-bearing animals, and fish taken in violation of the laws of one state are transported to a sister state and there confiscated by that state's authorities and in some cases sold by that state's officers and the money retained by them;

Resolved, That we favor a uniform law requiring the state authorities who confiscate such game, fur-bearing animals or fish, to return the confiscated property aforementioned to the authorities of the state where the same was unlawfully taken, or in case of perishable property, to sell the same and remit the net proceeds to the fish and game authorities of the state where the violations occurred.

WHEREAS, It appears that continued absolute protection for deer within the Grand Canyon National Game Preserve has resulted in a condition of overstocking, which, if continued, will be dangerous for the deer; and

WHEREAS, Such overstocking must eventually result in economic loss and might defeat the objects of the game preserve; and

WHEREAS, The great abundance of deer in the vicinity of the Grand Canyon National Game Preserve where they may be easily observed is of great interest and value; therefore, be it

Resolved, That the Department of Agriculture and the State of Arizona cooperate in placing into effect such a plan of limited utilization of deer within the Grand Canyon National Game Preserve as will prevent overstocking, assist in obtaining a drift of deer to outside ranges and at the same time maintain an abundant supply of such game.

Election of officers resulted in Chas. A. Jakways, Montana, being elected president; Frank M. Newbert, California, vice president; the secretary to be chosen by the newly elected president.

The next meeting will be held at Gardner, Montana, next October, in order that the delegates may have a chance to visit Yellowstone National Park and be present at a buffalo drive to be staged for their benefit.

PROPOSED LEGISLATION.

The Fish and Game Commission, after careful investigation, believes that the following changes in the fish and game laws should be made by the legislature in order to properly conserve the species concerned:

1. The bag limit on deer to be reduced to one buck with branched antlers. Those who secure hunting licenses now number more than 225,000, which is 75,000 more than the present standing army of the United States. This in-

creased number of hunters, together with the ease with which hunting grounds are reached, and the increased efficiency of firearms, makes it important that the annual toll be reduced. A one buck bag limit will also make law enforcement easier.

2. The status of the salmon makes it imperative that all netting of this fish in freshwater streams be prohibited. The marked depletion of the salmon run has conclusively proved that recommendations to past sessions of the legislature relative to netting in freshwater were entirely justified and the perpetuation of this valued food fish is dependent upon increased protection of this sort. Additional legislation is necessary to conserve the salmon run on the Klamath River, which furnishes the only satisfactory supply of salmon eggs for use of the hatcheries.

3. The demand for an increased angling license to furnish funds for a larger output of trout fry should receive favorable action by the legislature. In 1911 applications for trout fry to the amount of 7,000,000 were made. This past year the demand was for 70,000,000 of trout fry, an amount far in excess of the present hatchery output. It must be conceded that a greater hatchery output is needed to keep the streams of the state stocked, and the only possible way in which this can be increased is by making funds available for enlarging the work. Since the increase is demanded by the anglers themselves, thus making the burden fall on those who will most profit, and not upon the taxpayer, no difficulty should be experienced in passing the necessary legislation.

FISH FOOD NEEDED IN MOUNTAIN LAKES.

It is coming to be definitely known that there are many mountain lakes which have been stocked with trout that support but a small number of fish because of the lack of sufficient food supply. Undoubtedly some lakes are quickly depleted of their fish because no suitable spawning grounds are available, but in other instances the one condition lacking is that of better food supply. The Commission has already tried out some experiments in transplanting insects and crustaceans, but recent successes in eastern states makes it apparent that the stocking of such lakes with some small fish would greatly improve conditions.

A lake on the E. H. Harriman estate, within forty miles of New York City, was stocked with 3,500,000 smelt fry in 1919, as a preliminary step toward establishing a food balance. In the same year steelhead trout and land locked salmon were planted. Two years later fish weighing from 2½ to 4½ pounds were taken. In that each fish caught was gorged with smelt, their rapid growth and splendid condition was attributed to this introduced food supply. Certainly such experiments mean much to the future of angling everywhere. Since the history of plants is available for many mountain lakes, there is a splendid opportunity to try out this method of improving angling.

SUMMER RESORT EDUCATIONAL WORK A SUCCESS.

The summer resort educational work of the Fish and Game Commission now carried on, as a cooperative scheme with the National Park Service in Yosemite National Park, is attracting more and more attention from summer vacationists. Each year more people plan their summer vacations so as to take advantage of the nature guide service offered in Yosemite. During the 1922 season nature guides lectured to 39,500 persons. Most of the lectures were illustrated with either lantern slides or motion pictures, and all of them either dealt directly with the life and habits of some living thing of the Park or with the conservation of natural resources.

An outstanding feature of the work is the field trips offered twice daily, when people are given a chance to obtain first hand information regarding the living things of the park. Special field trips are offered for children. On Saturdays, an all day trip to the rim of the Valley gives opportunity for study of the change of fauna and flora from an elevation of 3000 feet to an elevation of 7000 feet. On these long trips a fine chance to study deer, grouse and mountain quail is afforded. The attendance on these field trips during the summer months amounted to 3039. During the office hours, thousands of questions relative to fish and game were answered.

The Yosemite nature guide service has really been an experiment in popularizing natural history in the national parks. Its spread to Yellowstone, Glacier and Sequoia national parks, and the plan to organize it as part of the educational program of the National Park Service shows that it has filled a real need. It is gratifying to find that the California Fish and Game Commission was instrumental in starting so important an educational feature in the summer resorts of the country.

BIRD BANDING.

Few projects concerned with bird study have had so notable a boom as has bird banding. Renewed interest in this subject in America is traceable to a report of bird banding activities made by Mr. S. P. Baldwin at a meeting of the American Ornithologist's Union a few years ago. Mr. Baldwin demonstrated so clearly that many important facts regarding distribution, migration and habits could be obtained from systematic bird banding that even the government took up the matter. Now the cooperators enlisted by the government number 490 and several bird banding associations have sprung up in various localities. During the past year six thousand birds were banded and much valuable information was recorded as a result of the 2500 "returns" and "repeats" secured.

It will be remembered that not less than eight ducks banded by the United States Biological Survey at Bear River, Utah, were taken in California previous to 1920. The banding of waterfowl at Lake Scugog, Ontario, Canada, in 1920, obtained remarkable results. Within the two years following thirty-five of the 250 ducks, or about 16 per cent of them, were killed and the bands recovered. Mallards and black ducks were secured as far away as Florida and Louisiana, and a blue-winged teal was taken at Port-of-Spain, Trinidad, British West Indies.

Sportsmen of California glibly talk of a northern flight of birds and make speculations as to where these birds were reared. However, no actual evidence, other than that of Utah birds, has yet been obtained. This is the more remarkable when it is known that there are many places where successful banding operations could readily be carried on. One such place is Lake Merritt, Oakland, where thousands of pintails and baldpates gather every winter. Without injury to the birds, many could be trapped and successfully banded. Although, because of closed season to the north during the breeding season, few returns might be secured, yet the mooted point as to whether the same birds return year after year could readily be ascertained. Someone should collaborate with the government bird banding department and take up work at Lake Merritt.

THE OPEN SEASON ON DEER.

Forest supervisors are requesting a later open season on deer as a means of lessening the number of forest fires. They contend that a large number of the fires in early fall are attributable to hunters, as can be seen by a report made to the Fish and Game Commission, a summary of which is published on another page. Fortunately the demand is for the latest open season consistent with the breeding habits of deer.

If hunters can be singled out among the many recreationists in the mountains during August and September as being responsible for fires it would seem reasonable to attack the problem in this manner. But this line of attack may defeat the very end in view for the putting over of the hunting season a whole month in the Sierra with the reduction of the open season to thirty days is very likely to cause such a concentration of hunting parties within the national forests that the fire risk will be greatly increased rather than decreased. Could the hunting season be logically placed in rainy months, it would be a different matter. Reduction of the bag limit to one buck, with perhaps total protection for mule deer, seems reasonable in view of proper conservation, but the demand for a much later and shortened season is one that has a direct bearing on the widely different conditions existant in the state and on the logical time for the securing of deer to be used for food.

The most necessary thing is that the deer season be consistent from the standpoint of deer conservation, with a second look toward the matter of fire prevention, for it appears to us that the hunter is but one of the many factors which contribute to fire loss.

The Forest Service is to be commended for its untiring efforts to lessen the loss due to forest fires and the hunters and fishermen of the state will be ready to accede to any reasonable measures to prevent forest fires. The question to be decided by the legislature is whether the advocated late and shorter open season on deer is consistent with the principles of game conservation, and whether the open season requested is the best means of attaining the results sought by the Forest Service.

NEW EDUCATIONAL FILMS.

The educational department of the Commission announces a new film entitled "The Salmon, King of Fishes." This film actually shows salmon spawning in the Klamath River and details the salmon-cultural work of the Commission. Scenes show the seining of salmon, spawning operations, shipment of eggs, etc.

Other new motion pictures include ducks and geese on their loafing grounds near Marysville Buttes. Some wonderful pictures showing the large numbers of waterfowl which still winter within the great valleys of California were recently taken.

These films may be obtained by schools, fish and game protective associations and other organizations.

The following announcement from the Weekly News Letter of the State Department of Agriculture for October 7, 1922, should be of general interest and should make certain individuals "prick up their ears."

Predatory Animal Force Renders Service in Lassen.

"During the month of August six traps, belonging to the Government and used by Hunter Frank W. Koehler in State-County-Federal cooperative work in Lassen County, were stolen. A Basque sheep herder, the guilty party, was seen taking the traps by Hunter Koehler. The matter was reported to Inspector Poole, of the cooperative predatory animal control service, conducted by the California Department of Agriculture and the U. S. Department of Agriculture, who made a trip to Ravendale to investigate and take such action as appeared to be logical. A complaint was sworn to and the man arrested, tried and convicted under the state law applying to such cases. A sentence of $100 fine and six months in jail was imposed by Judge M. R. Arnold of Susanville, together with a strong talk along the lines of refraining from such acts, since the various agencies are endeavoring to assist the stockmen in diminishing their losses of stock by eradicating the coyote. He stated that overt acts such as this not only retards the work of the men employed as hunters but is a menace to the general welfare of the community.

"It is believed that this will have a salutary effect and will be an object lesson that will prevent the theft of traps and animals such as have occurred in the past."—Joseph Dixon, Berkeley, Cal.

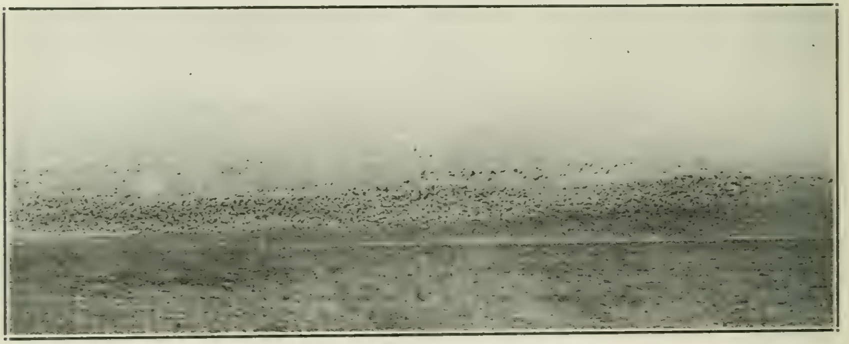

FIG. 13. Geese near Pennington, Sutter County, November 17, 1922. Geese are still numerous in some parts of California. Photograph by H. C. Bryant.

FINE OF $100 AND SIX MONTHS IN JAIL FOR STEALING TRAPS.

Section 13 of the Fur Trapping Regulations of the California Fish and Game Laws states: "Every person who shall disturb or remove the traps of any licensed trapper while trapping on the public domain or on lands where he has permission to trap is guilty of a misdemeanor." In spite of this warning the reports of California trappers show that many traps are stolen annually. In some instances only the animal in the trap is taken, while in other cases both the animal and the trap are stolen. The following experiences are typical. Mr. John N. Beck of Napa, reports a catch of 90 coyotes during the season of 1921-22. During that trapping season he had 30 traps stolen. In 1920, the writer found that certain woodchoppers were regularly stealing coyotes from the traps of Arthur Oliver near Firebaugh.

WHALES DISAPPEARING ALONG CALIFORNIA COAST.

A bulletin just issued by the State Fish and Game Commission entitled "A History of California Shore Whaling," by Professor Edwin C. Starks of Stanford University, calls attention to the past and present status of shore whaling along the coast of California and points out the rapid disappearance of the mammals responsible for a valuable industry. Early accounts show that whales were extremely numerous in the early seventies but by 1874 extensive whaling operations had reduced them to the point where shore whaling was much less profitable. At one time seventeen whaling stations were to be found along the coast. Fifteen to twenty years ago whaling was not considered profitable anywhere along the coast of California, but more recently two whaling stations have been established and profitably run.

The bulletin, which is well illustrated, furnishes an interesting outline of the history of whaling along the California Coast and describes each of the species of whales inhabiting California waters. The California gray whale, once most abundant of all, has now almost entirely disappeared. The humpback is the only whale that can still be called common, but it is not nearly so abundant as it was formerly.

Interesting pictures show flutings on the under surface of a humpback whale covered with goose-neck barnacles, which are found in patches on various parts. Apparently, living animals, therefore, are infested as are the bottoms of ships, but not with the same kind of barnacles.

The conservation of whales is very important at this time, and to be adequate must be international in character. At present, no protection whatever is afforded the largest of sea mammals and females are often killed while nursing young.

The bulletin, which is the sixth of the series of fish bulletins, may be obtained on application to the Fish and Game Commission.

MANY WHALES COMMERCIALLY EXTINCT.

According to figures given by Dr. B. W. Evermann in The Scientific Monthly. (Vol. 15, p. 310), the total number of whales taken by the Moss Landing Whaling Station of California from January 16, 1919, to May 3, 1922, was 832. "Seven different species were represented, as follows: Bottlenose, 1; sei, 1; California gray, 1; sperm, 5; sulphur-bottom, 5; finback, 33; and humpback, 781.

"These figures are of value in that they show the species of whales that now occur on the coast of California and the relative abundance of the different species. It is seen that only one—the humpback—is at all common. The scarcity of the others is significant; indeed, all but the humpback are already commercially extinct. Only the humpback remains in sufficient abundance to justify the establishment of a whale fishery on this coast.

"In 1853 Captain Scammon estimated that fully 30,000 California gray whales visited the California coast annually. The small catch of that species shows clearly that it has been almost wholly exterminated on the California coast. It is evident that the humpback whale also will soon be as seriously depleted unless effective measures be taken soon for its protection."

FURTHER TESTS IN USE OF GALVANIZED VESSELS IN SHIPPING FISHES.

In connection with the transportation of living fishes in galvanized iron vessels, further experiments along this line have been conducted, the results in each case tending further to prove that galvanizing is not harmful to fish. The recent experiments involve such fish as rainbow trout, brook trout, lake trout, and whitefish fry and fingerlings. Fish were in transit from periods ranging from 6½ to 35½ hours without change of water, and in each case they arrived at destination in good condition.—Service Bull., U. S. Bur. of Fisheries, No. 88, p. 5.

FOREST FIRES AFFECT FISH LIFE.

So obvious is the serious loss of valuable timber occasioned by the fires which annually devastate our forests, even those who are poorly informed are well aware of this condition. Less apparent but no less real is the loss, from the same cause, of other natural resources. The wild life of the woods and streams must suffer. Particularly through the food and game fishes is there a serious loss. Too little attention has been paid to this subject and consequently we have little reliable information. A few of the most immediate effects detrimental to fish life, following forest fires, are a quick rise in the temperature of the water, a lowering of the oxygen content, a change in the chemical properties, a destruction of shade. Most forest streams are slightly acid—a condition known to be well adapted to trout; the deposit of ash in the stream gives it an alkaline quality, most destructive to fish life. This deposit of ash also probably has an injurious mechanical effect on the fish, in addition to that incurred by the chemical change. These immediate and more easily recognizable effects of the fires do not cover all the loss that may be expected. More far-reaching is the destruction of food, increased turbidity of the water and the decreased protection from floods and droughts.—Service Bull., U. S. Bur. of Fisheries, No. 88, p. 2.

THE WILD PHEASANTS OF CENTRAL CALIFORNIA.

Several years ago there were ten pair of Chinese pheasants liberated close to Antioch. The ten pair soon scattered and the next season they were in different parts of central California. In 1921 I was at Isleton, a small town on the Sacramento River. I was out every day of the season after quail and cottontails. Early in the morning I have seen as many as fifty and sixty pheasants in a flock. They would, as a rule, be seen in the corn fields in the mornings and in the asparagus fields or the brush in the afternoons and evenings. As a rule, the hunters abide by the game laws around there, but I have seen boys around seventeen or eighteen years of age come to town with a barley sack as full of pheasants as they could get it and some in their coats. They would sell them to the Chinamen and restaurants about the towns of Isleton, Rio Vista, Ryde, Walnut Grove, Locke and Courtland.—Chas. Follett, Merced, California.

MULE DEER NEED FURTHER PROTECTION.

Big Game Refuge (District One B) is insufficient to maintain a breeding stock of mule deer, since there is not sufficient water during the hunting season. The southwestern portion thereof is entirely without water for deer. The deer leave this refuge to find water and the hunters have learned to wait on the runways and trails and wholesale slaughter results.

The mule deer is the largest and finest game animal in the State of California and it should have all the protection possible. Additional areas are needed to supply sufficient water in the present refuge, and additional areas must be set aside as refuges. The construction of roads for automobiles makes it possible for the hunter to reach every nook and corner of the deer range and only the strictest laws will make it possible for the mule deer to continue to exist. While this season a great many good specimens of this species were bagged, the writer can verify the fact that the mule deer are at present greatly on the decrease; it is very common to see does without fawn. There is also a certain area known as the Lava Beds consisting of approximately one and a half townships, which is considered by sportsmen a slaughter pen for mule deer. The most inexperienced hunter has been able to bag a limit on this area. On the opening day of the season of 1920, the writer estimated 160 hunters were bombarding the animals. From his own observation, he estimates 100 mule deer were killed in the Lava Beds during the winter of 1921-22. During this winter, coyotes took a large toll of mule deer. The writer has in evidence a wonderful large buck head, which he found with blood flowing from the carcass of the animal, and four large coyotes taking a meal of warm flesh. Two of the coyotes were there shot by the warden. Then the warden called upon the United States Department for assistance in exterminating the coyotes. Mr. Chas. G. Poole, in charge, placed two hunters and trappers in the lava beds, who succeeded in destroying the pests at the rate of approximately fifty coyotes per month. Up to this writing, approximately two hundred coyotes and wild cats have been destroyed. By this assistance, the Biological Survey will save hundreds of deer for the state.

The sage hen is almost extinct in Modoc County. This last season very few hunters were able to bag a limit of the defenseless birds. In the first place, a great mistake was made when August 1 was set for the opening date of sage hen season. This season there were very few young birds. Those found on the first of the open season were only about one-third grown. Even with better laws, it will take years to reinstate the sage hen to its former condition.—Geo. W. Courtright, Straw, California.

OREGON SPORTSMEN PROTEST.

Sportsmen living in the Klamath Falls district in Oregon complain that they are unable to utilize deer killed within the State of California. This district is unfortunate in that politically it is a part of Oregon but geographically a part of California. The securing of a nonresident license to hunt in California does not make it possible for them to carry their kill back into the state of Oregon. As a consequence, these Oregon hunters must eat up their venison while in the State of California and can not even take back the trophy until it is properly mounted. Some adjustment will doubtless be worked out to cover this situation.

ROOSEVELT WILD LIFE STATION.

Several years ago the Roosevelt Wild Life Experiment Station was established at the New York State College of Forestry "to commemorate the achievements in wild life and forest conservation of New York State's most distinguished citizen and hunter naturalist." This station's staff, headed by C. C. Adams, includes several well-known scientists who are devoting their time to research related to forest wild life. It is the endeavor of the station, through field and laboratory study, to develop new or improved methods of increasing the forest production of fish, fur and game animals and to show their application to general forest management. Among the completed projects is a biological survey of Palisades Interstate Park.

In the summer of 1921, a survey of beaver in northern Herkimer and Hamilton counties, New York, was undertaken, and in the summer of 1922 the beaver in Yellowstone National Park were studied. Roosevelt Wild Life Bulletin (Vol. 1, No. 2) contains the published results of these investigations under the authorship of Dr. Chas. E. Johnson and Mr. Edward R. Warren, respectively. The papers are well illustrated and both emphasize life history and habits. Considering the time the authors spent in the field, the results give promise of further splendid contributions to knowledge concerning the life and habits of this most noted of fur bearers.

There is a dearth of fundamental knowledge of the life history and habits of fish and of game and such an institution as the Roosevelt Wild Life Experiment Station has unlimited opportunity to supply this need. It is to be hoped that institutions of this kind will spring up in every state, so that sound knowledge may replace guess work and the results of scientific research come to form the basis of protective legislation.

SANTA BARBARA TO FRAME PROTECTIVE LAWS.

The city park commissioners of Santa Barbara are making a progressive and commendable move in the direction of a city ordinance which will make of all their city parks wild life refuges. For several years a pond in one of the city parks near the shore has been designated by the commissioners as a refuge for water birds. Owing to the general prohibition of the use of firearms within the city limits, the ducks which flock there have learned to feel themselves so safe that poachers now find it an easy matter to approach them near enough to throw clubs and stones with stunning or fatal effects. There seems to be no statute, city, state, or federal, which makes this a legal offense during the open season on waterfowl.

Not only does the protection of wild fowl add to the delights of these parks, but Oakland has gained fame for Lake Merritt as a refuge for ducks and other water birds, and for the annual duck pageant held there. Waterfowl at Golden Gate Park, San Francisco, are also a great attraction. The establishment of such refuges in the heart of a city affords pleasure to the numerous park visitors, has great educational value, fosters the love and appreciation of birds, and ultimately serves the interests of true sportsmen.

FOX FARM TO BE ESTABLISHED NEAR SAN BERNARDINO.

California is to have another fox farm. Mr. Jacob Host, who represents the Bear Lake-Silver-Black Fox Ranch Company, owners of two established fox farms in the middle west, is in charge of the new enterprise. He has been granted a permit by the United States Forest Service to occupy twenty-two acres of land in the Cajon Pass just north of San Bernardino. Here the company contemplates the installation of an ice plant to preserve the food, the keeping of goats for milk, and the raising of poultry for feed.

The Bear Lake-Silver-Black Fox Ranch Company expect to ship thirty pair of foxes to the new California farm.

GAME LAW CHANGES IN OTHER STATES.

Interesting recent modifications of state game laws are as follows:

New Jersey requires persons hunting woodcock from October 1 to November 9, to take out a special license costing $2, in addition to the regular hunting license. Chinese and ring-necked pheasants are now protected throughout the year for an indefinite period in Maryland, where an attempt is being made to establish the species. Virginia prohibits the baiting of wild turkeys or the taking of their eggs except for propagating purposes under permit from the commissioner. The closed season for quail in Massachusetts has been continued until 1925 in Dukes, Essex, Hampden, Middlesex and Nantucket counties.

The open season for big game has been reduced in several instances. A law was passed in Virginia sanctioning the practice of the department of game and inland fisheries of establishing game refuges on private lands by contract with the owners. All lands so set aside are required to be conspicuously posted as state game sanctuaries.

A summary of the provisions of Federal, State and Provincial Statutes, and a list of officials from whom copies of state game laws may be obtained, is contained in Farmers' Bulletin 1288, Game Laws for 1922, by George A. Lawyer, chief United States game warden, and Frank L. Earnshaw. The bulletin is available free upon application to the United States Department of Agriculture, Washington, D. C.

Regulations pertaining to the propagation and sale of migratory waterfowl and game are given. The text of the Lacey and Migratory Bird Treaty Acts and regulations pertaining to this country and also in Canada are included.

MOURNING DOVE A MIGRATORY BIRD, COURT DECIDES.

The mourning dove, known in some localities as the Carolina or turtle dove, is a migratory bird coming within the protection afforded by the Migratory Bird Treaty and the Act of Congress to give it effect, although individuals of the species remain within the borders of certain states the entire year. This decision was rendered in the case of the United States against Joseph H. Lumpkin, brought to trial at Athens, Ga., November 14, before Federal Judge S. H. Sibley and a jury.

The defendant, who was charged with killing mourning doves during the federal closed season, contended that the birds which he had killed had not migrated but had remained in Georgia the entire year, and for this reason were not covered by the federal statute. The case, which attracted widespread attention, was attended by prominent attorneys of Georgia.

The court held as a matter of law that the mourning dove is protected by the Migratory Bird Treaty Act and Regulations, and instructed the jury that the only question of fact to be decided by it was whether the defendant actually killed mourning doves in the closed season as charged in the indictment. The trial consumed two days and resulted in the jury returning a verdict of guilty, and the imposition of a fine of $25 and costs.

BEAVER FARMING PROMISING IF PROPERLY CONTROLLED.

Beavers are of importance as fur-bearers and conservators of water and soil. Their unique habits make them animals of general interest. In certain types of forest country, or farms, in irrigation ditches, and along trails, roads, and railroads, they are capable of doing serious damage. It becomes necessary in such cases to remove them or to control them intelligently.

Their control, however, is not difficult. United States Department of Agriculture Bulletin 1078, Beaver Habits, Beaver Control, and Possibilities in Beaver Farming, by Vernon Bailey, of the Bureau of Biological Survey, discusses in detail the kinds of traps, fences, and other control measures which have proved satisfactory. The bulletin also points out that beaver farming may prove a successful branch of fur farming if carried on in suitable localities. Beavers in our national forests if properly controlled, would conserve water and soil, weed out timber of little value, and yield good returns in fur. In connection with projects for reforestation with conifers on well-located, burned and cut- over timber lands, beaver culture might prove profitable. These lands are frequently covered with a second growth of aspen, willow, and pin cherry, which are ideal food for beavers, while having little commercial value.

Aspens and willows are abundant also in the certain northern areas of Canada and Alaska, where beavers were formerly very numerous. In such areas experiments might be made to determine the practical possibilities in beaver farming.

Only two centuries ago beavers ininhabited the greater part of the North American Continent and were an important source of food and warm clothing to the native people. Traffic in their skins promoted early settlement of the country. They have been exterminated over much of their area by intensive trapping, but for the last 20 years they have been given special protection in many sections of the country and under favorable conditions have thrived and increased rapidly.

While it would be obviously unwise to restore the animals to cultivated fields and orchards in agricultural areas, there are still many localities where they could be introduced without harm. By storing water in the reservoirs along mountain streams they would help prevent floods and extensive erosion and would increase stream flow in dry weather.

Beavers with the darkest, most beautiful, and most valuable fur are found along the southern shore of Lake Superior, in Wisconsin and Michigan. In other localities the fur is paler and less desirable. In making suggestions relative to raising beaver for fur, the importance of using the best types of animals for breeding stock is emphasized.

Department Bulletin 1078 describes in considerable detail the interesting life and habits of beavers, which rarely dig on the surface of the ground and never make a burrow with an exposed entrance. In carrying materials they use their strong incisor teeth for transporting logs or large pieces of wood, and for mud and small sticks and twigs from the bottom of the pond to be placed on the dam or house, they use their forelegs as hands and arms. The flat heavy tail is a rudder or propeller in the water and a prop or brace on land.

Beavers occasionally damage choice trees but the most serious damage is occasioned by their dams, which raise the water levels in streams, ponds, or lakes, flooding low ground and frequently killing great areas of valuable forest trees. When railroad grades are flooded in low ground the result may be serious. A suggestion is made in the bulletin for using an outlet pipe to keep beaver ponds at a desired level as one means of preventing heavy damage. One of the simplest and most important means of beaver control is fencing. Many of the woven-wire stock-fences are satisfactory. Full directions for trapping with various types of traps are given in the bulletin. Light-furred pelts bring from $6 to $8 each, heavy dark-brown skins from Canada and Alaska bring from $20 to $25 each, and the rare "black beavers" from the south shore of Lake Superior from $38 to $50.

LIFE SENTENCE FOR MURDER OF FEDERAL GAME WARDEN.

For the murder of Edgar Lindgren. United States game warden in charge of the Iowa district, the maximum penalty, life imprisonment, was imposed upon Louis Esposito, who was convicted by a jury October 11. Warden Lindgren was shot and fatally wounded while discharging his duties near Big Lake, Iowa. While patrolling he encountered three Italians hunting in violation of the federal laws. Lindgren attempted to arrest them, and one of the three fired at him, almost blowing off his right hand. When the warden turned to get under cover he was shot twice in the back and once in the side. Esposito's brother, Sebastiano, is facing trial on the same charge. The third man is not charged with actually shooting at Lindgren.

MIGRATORY BIRD LAW ENFORCEMENT.

According to the last report of the Chief of the Bureau of Biological Survey, from 25 to 28 regular salaried wardens were employed in the enforcement of the Migratory Bird Treaty Act. These were aided by 48 United States deputy game wardens, receiving a salary when employed during short intervals in emergencies, and by approximately 350 United States deputy game wardens stationed at suitable points throughout the country, who receive a nominal salary of $1 per annum and cooperate by reporting violations, thus bringing about better observance of the law.

During the fiscal year 194 convictions were obtained out of 772 cases pending. California is credited with but two of the convictions obtained in federal courts.

TOADS OF SOME USE IN CURBING CERTAIN PESTS.

Toads have been reputed to aid in curbing the numbers of injurious insects and other similar pests. To ascertain the facts in the case the Biological Survey of the United States Department of Agriculture has analyzed the contents of the stomachs of 502 common toads, and reports that while the findings regarding the choice of food are of interest they thus far fail to demonstrate that toads are of great economic importance. Toads go constantly about their own work of gaining a livelihood, and so undoubtedly fill their proper place in nature. They are never very numerous in one locality, however, and as they can not adopt the methods of birds and traverse wide stretches of land to aid in combating abnormal local increases of crop and garden pests their influence is not strongly felt. The investigation shows that a certain portion of the toad's food is made up of injurious insects and other pests of growing plants, and that the toad performs some service in such places as greenhouses, gardens, fields of small grain, and golf courses. Any harm that toads do in the consumption of beneficial beetles and other insects useful to man is of little economic importance and does not warrant their indiscriminate destruction.

THE BODY TEMPERATURE OF BIRDS.

Every student of zoology is taught that certain vertebrates have a body temperature below the temperature of the human, and hence are called cold-blooded animals, whereas others of a body temperature about the same or greater than that of the human, are called warm-blooded animals. It is not often, however, that an explanation is given of the underlying cause for this difference in temperature.

A study of the body temperature of birds, by Alexander Wetmore, published in the Smithsonian Miscellaneous Collections (Vol. 72, No. 12, pp. 1-52), explains a certain diurnal variation in the temperature on the basis of the metabolism of the individual as reflected by its activities. With birds there is no constant relation between the normal temperature of the surrounding medium and the body cavity such as we find in cold-blooded animals.

Body heat in all animals is caused by tissue changes during active work performed by various organs or parts. In the group that we class as warm-blooded, these changes are more rapid and intense, so that heat generation may be in excess of heat radiation. There is a more perfect control of heat radiation in the warm-blooded group.

Of particular interest is the evidence presented to show that the air sacs which are found within the bones of birds have a relation to body temperature. With animals as active as are birds, means of relief for over-heating must be well organized; the extension of the air sacs through the body cavity is excellent for this purpose.

The rare occurrence of frozen feet among birds is not, as yet, possible of explanation.

"It may be assumed as certain that heat production and local control are under nervous direction and that these two functions are directly concerned in whatever mechanism has developed for temperature control.

"It seems probable that in our living fishes there is little actual temperature control. In Amphibia [toads, frogs and salamanders] this regulation is developed to some extent and it has progressed somewhat farther in modern reptiles. In the bird, however, the regulation of body temperature has reached its highest point, though birds stand second to mammals from an evolutionary standpoint. Proof of this is found in the fact that birds have the highest body temperature known, and that none of them hibernate (in spite of ancient belief to the contrary)."

When ranged by families, the highest temperatures noted are to be found in pigeons, cuckoos, woodpeckers and in the perching birds, beginning with the flycatchers and ending with the thrushes. The swallows as a group, possess the lowest average body temperature, only the rough-winged swallow showing an average body heat above 107.5 degrees. On the other extreme, in the family of flycatchers, there are five species in which the mean temperature for male or female is 110 degrees, or more, and seven other species of birds hold the same record. The highest average temperature for both sexes is that of the western wood peewee with a mean of 110.2 degrees. The highest single reading believed to be valid was found in this species when the temperature was taken of a bird killed in the Graham Mountains of Arizona, which registered 112.7 degrees.

Although independent of external temperature, the temperature of a bird appears to advance a few degrees as the day advances. With the exception of the phalarope, the avocet, and certain other shore birds, where the male performs the duties of incubation, the body temperature of the female is slightly higher than that of the male.

Full summary of records of the body temperature of 327 species of birds are appended, together with a supplementary table of temperatures taken from available literature which adds temperatures for 92 species. The short bibliography shows that little has been written along this line heretofore.—H. C. Bryant.

FACTS OF CURRENT INTEREST.

The open season on waterfowl has proved a splendid one for the hunter. Ducks and geese have been plentiful.

* * *

Fall spawntaking operations on the Klamath closed on November 15th, after a most successful season. At Klamathon 20,000,000 salmon eggs were secured.

* * *

A wonderful concentration of ducks and geese in the Butte Creek district west of Marysville Butte has been evident this fall. Birds seemed to be numbered in the millions.

* * *

Several salmon, marked four years ago and liberated in the Klamath River, were taken this year during spawning operations.

* * *

During the past biennium confiscations of illegally taken fish and game amounted to over two tons of venison, 4,500 ducks, 25 tons of fish and 12 tons of lobsters and shellfish.

* * *

Brood trout at the Mount Shasta Hatchery will this year furnish 10,000,000 eggs. The pond system is responsible for a dependable supply of eggs.

* * *

The imports of fresh fish from Mexico in 1921 amounted to 6,699,817 pounds, as compared with 8,121,225 pounds the previous year. The principal species imported were barracuda, 3,036,262 pounds; flounders, 1,314,918 pounds; spiny lobster, 943,547 pounds, and white sea bass, 500,075 pounds.

* * *

Results of salmon marking experiments have shown that salmon from the Sacramento River migrate at least as far north as Shelter Cove, and that salmon from the Klamath River contribute to the catch at Monterey Bay.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JULY, AUGUST AND SEPTEMBER, 1922.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Colusa, Tehama, Glenn, Butte	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California
Albacore										41		10,686,557	16,073	1,414,653	12,117,324	
Anchovies								85,150		2,150		798			88,098	
Barracuda								81	22	2,415	42,189	635,267	373	152,052	832,399	203,988
Bluefish									1,560	14,308					15,868	
Boccaccio			22					6,454	27,382	106,839					140,697	
Bonito									13,500		9,077	733,656	60	15,508	771,801	1,080
Carp				265		549	10,219	2,360							13,393	
Catfish		2,652				787	42								3,481	
Chilipepper									13,982	2,556					16,538	
Cultus Cod	6,835	1,968	44					144,987	16,297	15,581					185,712	
Dolphin																
Eels														20	20	
Flounders	210						154	93,467	85	103		437			94,456	
Grayfish							860	10,153						21,055	32,068	
Greenfish																
Hake								24,059	600						24,659	
Halibut	29,563	34,660	143					31,596	555	14,962	83,788	210,162	599	25,813	431,841	550,435
Hardhead																
Herring																
Kingfish								896	5,818	22,155		11,928		1,624	42,421	70
Mackerel									9,989	228,239	14,136	272,150	5,671	15,205	545,390	7,838
Marlin																
Mullet														2,563	2,563	
Perch	13,068							13,823	13	2,196	24	9,039	209	2,483	40,855	145
Pike						31	461	90							585	
Pompano								252	7			3,752			4,011	
Rock bass											735	86,252	1,349	79,805	168,141	1,424
Rockfish	9,377	1,054						172,952	65,632	114,748	4,116	86,168	2,841	34,850	491,738	1,430
Sablefish								41,482	417	2,382					44,281	
Salmon	1,668,901	779,937	6,366	245,162		174,412	476,669	556,312	15,668	5,542	30				3,928,999	
Sand Dabs								212,250	6,050	726		2,358	121		221,505	
Sardines								88,340	1,800	15,689,556		8,551		175,415	15,963,662	
Sculpin												669		630	1,299	
Sea Bass—Black											352	13,086		11,251	24,689	1,680
Sea Bass—White			14,195					20,059	41,976	494	32,757	691,498	13,087	52,967	867,033	375,857
Sea Trout								25				180	221	3,312	3,738	
Shad				28			12,588	98							12,714	
Shad—Buck							1,014								1,014	
Shad—Roe				35			3								38	

Sheephead											25	59		124	208	
Skates								11,418	150						11,568	
Skipjack									11,136			3,473,124		4,733,629	8,217,889	224
Smelt	5,488		6,215					10,393	80,883	22,141	24,616	23,118	15,965	3,549	192,366	1,946
Sole	130							1,889,167	4,081	26,110	2,007	3,435	85		1,925,015	
Splittail							1,018								1,018	
Striped Bass			67	4,356		703	69,111	64,928							139,165	
Stingaree																
Suckers																
Surf Fish																
Swordfish												20,390		1,245	21,635	
Tomcod								17,512	265						17,897	
Trout—Farm																
Trout—Steelhead	2,345														2,345	
Tuna											2,065	596,437			598,502	
Tuna—Bluefin												1,644,278		773,192	2,417,470	
Tuna—Yellowfin												507,960		422,337	930,297	832,033
Turbot								625							625	
Whitebait	12,473							18,313							30,786	
Whitefish												2,333			2,333	
Yellowtail											11,316	572,514	444	718,989	1,306,254	20,253
Miscellaneous	286						10	5,429	1,936	924	1,911	21,188	736	290	32,710	400
Total fish	1,748,676	820,271	27,052	249,846		176,485	572,149	3,522,701	319,804	16,274,168	232,144	20,317,344	57,832	8,662,552	51,981,024	1,998,803
Crustaceans:																
Crabs (doz.)	472		364					25	17						878	
Ecrevisse (doz.)																
Shrimps			28,558				33,755	187,158							249,471	
Spiny lobsters																
Mollusks:																
Abalones										656,721	3,595				660,316	
Clams—Cockle	999	124	3,881												5,004	
Clams—Mixed	1,326		1,554				385								3,265	
Clams—Pismo									337		61,202				61,539	
Clams—Softshell	321	481	20,400				51,216	13,188							88,606	
Cuttlefish								1,790	17	12,741					14,548	
Limpets																
Mussels							319	1,281		1,290	54		15,197		18,144	
Oysters—Eastern (No.)			606,801												606,801	
Oysters—Native																
Snails																
Squid										115		15			130	
Miscellaneous:																
Frogs (doz.)																
Terrapin (doz.)					5										5	
Turtles																135

All amounts shown in pounds unless otherwise specified.

NOTES FROM THE STATE FISHERIES LABORATORY.

WILL F. THOMPSON, Editor.

THE LABORATORY STAFF.

Dr. Tage Skogsberg has accepted a position as research assistant to Dr. Kofoid of the University of California. Dr. Skogsberg has been engaged in writing a report upon the purse seine fisheries of Southern California, and plans to finish that in December, when he will leave to take up his new work. The laboratory members have enjoyed their association with Dr. Skogsberg and wish him good fortune in the change.

Mr. O. E. Sette, who has been at the laboratory since his graduation from Stanford University last June, leaves October 1 for Monterey. He is to work with Mr. W. L. Scofield there upon the preparation of a sardine report.

Miss Frances N. Clark, librarian and scientific assistant, has left on a leave of absence to undertake further work at Stanford Uuniversity during the fall quarter. She is to return in January, 1923, and her place will be filled temporarily.

THE ALBACORE RUN.

The run of albacore has this year proved disappointing, the season being relatively light and closing early. Some apprehension as to the condition of the fishery would seem necessary, since the lack of fish seems accompanied by a lack of older year classes. No definite statement as to the reality of this can be made, however, until the completion of the present work upon the life history of the albacore. It is unfortunate that it has not been posible to follow the complete course of the season's run because of the diversion of the assistants to other work.

THE LIBRARY.

Due to lack of funds, no extensive additions have been made to the library during the past three months. As the library is vital to the prosecution of scientific work, it is hoped that this condition will soon pass.

DEPLETION OR FLUCTUATION.

There is at present in progress a very animated discussion in British fishery circles as to the relative importance of natural fluctuations in abundance and over-fishing, as witness a recent meeting of the British Association for the Advancement of Science, addressed by a prominent member of the trade. The lack of accurate data on catches made in past years seems to have provided room for very divergent views, and the failure of the enforced closed season of the war period to lead to a rapid recovery seems to have inspired various men to criticize the evidence for over-fishing. They demand, instead, an intensive study of the great natural fluctuations which occur.

That such a study is of the greatest importance can not be doubted, as at present it is not even known what fisheries are subject to great changes in abundance. It is commonly accepted that the cod and herring are such fisheries, but the knowledge of the subject as regards the majority of the species seems scant. It is worthy of note that this question as to the existence of great fluctuations is of the utmost importance to the Pacific Coast fisheries, such as albacore, and that the State Fisheries Laboratory has for one of its principal objects the detection of such fluctuations and a study of their causes. Every effort is being made, for instance, to follow dominant year classes in the sardine fishery.

The discussion as to the presence or absence of depletion from over-fishing in the North Sea has brought home in a vivid way the lack of accurate statistics there, and the trade itself is urging with considerable vehemence the institution of a competent statistical system. In view of the emphasis which has come to be placed upon the need for such, it is obvious that the government in California should spare no effort to maintain and improve the present statistical system.

In so far as over-fishing is concerned, critics have pointed out that there was not a rapid recoverey in abundance of all fish in the North Sea after the war with its enforced closure of grounds, and have assumed that the lack of such a recovery proved the absence of over-fishing. It would seem to us, however, that such a conclusion is unjustified, and we will await with some interest the more careful summation of the evidence which we feel sure must follow the initial discussions. The conclusion seemingly involves the assumption that the reproductive power of the species is unhampered, and that there are no obstacles to recovery of lost ground. But depleted species must depend upon a lessened number of spawners, and it must make its way again into grounds occupied by other species of animals who have made good use of their opportunities in the past. A species of fish, unhampered by man, is granted to have a natural limit of increase, but surely the conclusion has not been justified that the limiting influences operate only after a certain abundance is reached. It would, indeed, seem that no conclusion can be drawn from a single year's observation, and that a question as to the fundamental character of the existence of a species is raised. The evidence of future catches, and the more mature conclusions of North Sea naturalists will assuredly be of the greatest interest.

CONSERVATION IN OTHER STATES.

OPEN SEASON ON ELK DEMANDED IN WASHINGTON.

Certain hunters in Washington are drafting a bill to present to the Washington legislature which provides for an open season on elk previous to 1925, the time now set for the opening of the season. They contend that there are too many bull elks. Licenses issued are to be limited to bulls only.

It seems doubtful whether the herds of elk still remaining in the northwest can withstand an open season and many are demanding that a distribution to other parts of the state be made of animals taken from the present herd rather than a toll to be taken by the hunter.

SOUTHWESTERN ALASKA FISHERIES RESERVATION.

On November 3 the President signed an executive order establishing a government fisheries reservation, including Bristol Bay, Kodiak and Afognak waters, and Cook Inlet, in southwestern Alaska. The text of the order is as follows:

Executive Order.

Whereas it has become apparent that certain valuable fisheries of Alaska have been seriously impaired and are in danger of further depletion, and that it is necessary to establish authority to meet the exigency which has arisen for the protection of these fisheries, and

Whereas by Executive order issued under date of March 3, 1913, modified by an order of August 11, 1916, a reservation known as the Aleutian Islands Reservation was created, and by an Executive order under date of February 17, 1922, a reservation known as the Alaska Peninsula Fisheries Reservation was created, including therein the lands and the territorial waters of the United States contiguous to the lands covered by said executive orders:

Now, therefore, I, Warren G. Harding, President of the United States of America, by virtue of the power in me vested by the laws of the United States, do hereby set apart as a preserve to more effectively insure the protection of the fisheries and for their encouragement and development, in addition to the above reservations, a reserve of lands and waters, which said reservation shall be known as the Southwestern Alaska Fisheries Reservation, which shall include all territorial waters, and the lands within one-half mile of the shores thereof, within the lines defined as follows:

From the northeasterly point of the Alaska Peninsula Fisheries Reservation at Cape Menshikof, Bristol Bay, northwesterly to a point in latitude 58° 32′ north, longitude 162° 12′ west, off Cape Newenham; thence to a point in latitude 59° 15′ north, longitude 162° 0′ west; thence eastward along parallel of latitude 59° 15′ north, to longitude 155° west; thence to a point in latitude 61° 20′ north, longitude 151° 20′ west; thence to a point in latitude 61° 20′ north, longitude 150° 10′ west; thence to a point in latitude 61° 35′ north, longitude 149° 40′ west; thence to a point in latitude 61° 35′ north, longitude 149° 0′ west; thence to a point in latitude 60° 40′ north, longitude 149° 0′ west; thence to a point in latitude 60° 40′ north, longitude 151° 0′ west; thence to a point in latitude 57° 30′ north, longitude 151° west; thence to a point in latitude 55° 0′ north, longitude 157° 0′ west; thence to low-water mark at the eastern extremity of Foggy Cape on Sutwik Island; thence to point of beginning.

Fishery operations within the said Southwestern Alaska Fisheries Reservation shall be subject to such regulations and restrictions as shall be issued by the Secretary of Commerce, in addition to the general fisheries laws and regulations of the United States as administered by the Secretary of Commerce.

The reservation hereby established shall not interfere with the use of the waters, islands or other lands embraced therein for any purpose not inconsistent therewith, nor with the operation therein of the laws now or hereafter applicable to the public lands in Alaska, nor with the respective jurisdictions of the Secretary of Agriculture and the Secretary of the Interior thereover.

Warning is hereby expressly given to all unauthorized persons not to fish in or use any of the waters herein described or mentioned.

Warren G. Harding.

The White House, November 3, 1922.

OREGON INTRODUCES MOOSE.

Recently several moose, the only ones in Oregon, were liberated in western central Oregon, in Douglas County on Lytle Creek, a tributary to Lake Tehkeniche. The moose were planted within two miles of the ocean, along a low range of foothills while the shore of the lake has many miles of marsh land which is said to be well adapted for them. Oregon has a number of large game refuges, but none of them contain suitable marsh land for moose.

The Game Commission ordered six calf moose, three males and three females.. After arriving at Portland, one of the males died. The animals weighed about 250 pounds each, and were very tame. To give them every opportunity to become established, a man will keep a watch on them. This attempt to add another species of big game to the state is being watched with great interest by the sportsmen of Oregon.—OVERTON DOWELL, JR., Mercer, Oregon.

WEST VIRGINIA ORGANIZES WILD LIFE LEAGUE.

A Wild Life League, designed to stimulate the conservation of natural resources, has been established in West Virginia, and Mr. Howard H. Cleaves, formerly director of the Natural History Museum of San Diego, has been placed in charge. Branch leagues are being formed in all of the fifty-five counties of the state. A state convention, composed of delegates from all the various branches will meet annually. An illustrated monthly publication devoted to the interests of the out-of-doors in West Virginia is contemplated.

NEBRASKA ENUMERATES EXTINCT GAME.

A bulletin of the Nebraska Conservation and Soil Survey (No. 12) by R. H. Wolcott, entitled "Nebraska's game resources and their conservation," records eight species of big game mammals extinct, impounded or protected throughout the year. The number of game birds now extinct, or practically extinct, number twelve.

LARGE TAKE OF TROUT EGGS OBTAINED IN FISH LAKE, UTAH.

The Utah State Game Department and the Bureau of Fisheries obtained 6,000,000 eastern brook eggs from Fish Lake on the Fish Lake Forest, Utah, in 1921. This is double the amount taken any other season and eggs were still available when the work closed. The increase in the amount of spawn of the eastern brook trout obtainable is credited by the Bureau of Fisheries to the consistent planting of three and four inch fish which has been done by the bureau since 1917, the total number planted by them being 141,000. Last spring nearly 10,000,000 eggs of rainbow trout were obtained from Fish Lake, making a total of at least 15,000,000 eggs taken during 1921.

MONTANA PLANTS WHITEFISH.

Montana has successfully introduced the Great Lakes whitefish, with the object of developing a commercial fish. The plant made in St. Mary's Lake is expected to eventually furnish the tables of Montanans with this most delectable food fish of the eastern United States.

OREGON ADOPTS POLICY OF NUMEROUS SMALL HATCHERIES.

Oregon has definitely decided upon the small hatchery with rearing ponds as against centralized hatcheries with larger capacity. The smaller hatcheries are situated near the localities where there is need for large plants of fry, and the fish, after being kept in rearing ponds at the hatchery, are liberated in nearby streams, or carried by auto trucks and planted by experienced hatchery men.

BIRD PROTECTION IN ITALY.

With regard to birds in Italy, Mr. Hawksley writes: "The last government introduced a bill for the better protection of birds in Italy, under the form of a national game law, but this shared the fate of its twenty-four predecessors in not being passed before the government was turned out of office. * * *

"We have put an entire stop to the blinding of birds and the sale of blinded birds in the city of Rome, but it is carried on very largely in Umbria and Lombardy. Some years ago it was hoped to make a special effort for the protection of birds around the birthplace of St. Francis of Assisi, but the diversion of a legacy unfortunately prevented the carrying out of this purpose."—*Bird Notes and News, X, No. 2, 1922.*

UNITED STATES FOREST SERVICE COOPERATION.

PAUL G. REDINGTON, Editor.

FOREST SERVICE SUBMITS SUPPLEMENTARY GAME REPORT.

A supplementary game report was submitted to the California Fish and Game Commission, under date of December 15. It contains a summary of reports of the supervisors of the various forests, emphasis being placed on recommendations as to the open season and bag limit for deer, on the number of hunters, and the number of deer killed in the seventeen national forests of the state.

The following tabulation is based on the best information available, showing the numbers of hunters within each forest during the past season, the number of deer killed—for which there is a record, the breeding season, based on observations and the best information available, the supervisors' recommendations regarding the proper hunting season, and the bag limit, with the number of arrests and convictions secured by forest officers during the past year with the number of cases turned over by forest officers to your deputy state game wardens.

It should be remembered that the information is only an approximation, as there is absolutely no way of definitely determining the actual number of hunters who visited each forest during the season. Also, the number of deer killed, as shown in the tabulation, is only the number which the local forest officers had definite knowledge of. It is believed this number is far less than the number actually killed as at present there is no way to make an actual check on the kill.

The rutting season is based upon forest officers' observations and observations of local people, coupled with the date when fawns are first seen in the spring in each locality. Many claim that the breeding season is influenced by the occurrence of fall storms and the variations in altitude. The supervisors have recommended hunting seasons that would practically expire before the beginning of the rutting season. They are nearly all in accord regarding the reduction of bag limit to one buck. The number of arrests made and convictions secured by forest officers for violation of the game law were cases where immediate action was necessary Many cases were turned over to your deputy warden.

Practically every supervisor in the state has recommended against the use of dogs in hunting deer. Many sportsmen throughout the state also concur in this opinion.

Forest	Number of hunters	Number of deer killed	Beginning of rutting season	Hunting season recommended	Bag limit	Arrests by forest officers	Cases turned over to state
Angeles	----------	18	Oct. 15	Sept. 16–Oct. 15	----------	4	
California	5,000	2,000	Oct. 15	Sept. 1–30	1	2	1
Cleveland	3,000	215	Sept. 20	Sept. 1–30	1	8	5
El Dorado	3,000	300	Nov. 1	Sept. 16–Oct. 15	1	3	
Inyo	1,300	150	Nov. 1	Oct. 1–31	1	2	1
Klamath	----------	469	Nov. 1	Sept. 16–Oct. 15	1	3	
Lassen	3,200	400	Oct. 15	Sept. 16–Oct. 15	1	1	2
Modoc	----------	300	Nov. 1	Sept. 16–Oct. 15	1		
Mono	----------	----------	Oct. 20	----------	1		
Plumas	1,800	239	Nov. 30	Sept. 16–Oct. 15	1	3	8
Santa Barbara	3,000	345	Sept. 1	Aug. 16–Sept. 15	1	2	
Sequoia	----------	----------	Nov. 15	Sept. 16–Oct. 15	1	1	1
Shasta	1,130	417	Nov. 15	Oct. 1–31	1	2	3
Sierra	----------	250	Nov. 1	Sept. 16–Oct. 15	1		
Stanislaus	5,750	700	Oct. 15	Sept. 1–Oct. 15	1		
Tahoe	----------	----------	Nov. 1	Sept. 16–Oct. 15	1		
Trinity	2,000	586	----------	Sept. 16–Oct. 15	1	1	6

RECOMMENDATIONS.

Based upon the supervisors' recommendations included in this report, I desire to contiue the recommendations submitted in my report of May 15, except as hereafter modified.

I can not urge upon your commission too strongly the desirability, both from a game conservation and fire protection standpoint, of having a uniform hunting season for the entire state. This season should not begin before September 16, and should extend not longer than one month, with a bag limit of one buck. If this can not be accomplished for the Coast Range, then the state should be divided into two game districts, so far as deer are concerned—one to include the Coast Range and the other the remainder of the state. The hunting season in the Coast Range should not in any case begin before September 1, extending one month, with a one-buck bag limit.

I also wish to recommend a closed season of five years on mule deer in order that that species may not be exterminated.

Certainly the data included in this and my former report, which are based on the best information obtainable, amply justify these recommendations.—Paul G. Redington, District Forester.

FISH AND GAME COMMISSION—STATEMENT OF EXPENDITURES

For the Period April 1, 1922, to June 30, 1922, of the Seventy-third Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners	----------	----------	$87 01	----------	$87 01
Executive offices	$59 39	$4,289 99	1,123 32	$10 00	5,462 70
Printing	----------	----------	3,765 73	----------	3,765 73
Research and publicity	13 50	1,050 00	212 86	----------	1,276 36
Accident and death claims	----------	----------	451 48	----------	451 48
Department totals	$72 89	$5,339 99	$5,640 40	$10 00	$11,043 28
Commercial fishculture and conservation:					
Superintendence	$24 53	$2,461 50	$1,083 70	$1 67	$3,571 40
Inspection and patrol	1,009 42	4,677 08	986 93	2 90	6,676 33
Research	23 57	4,454 31	455 28	325 15	5,258 31
State laboratory construction	28 38	----------	1 00	----------	29 38
Statistics	280 39	1,930 91	157 93	----------	2,369 23
Market fishing license commissions	----------	----------	125 00	----------	125 00
Propagation and distribution of salmon	2,130 20	2,854 63	562 73	184 26	5,731 82
Department totals	$3,439 73	$16,378 43	$3,370 57	$513 98	$23,702 71
Sporting fishculture and conservation:					

CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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RABIES IN A MOUNTAIN LION.

By Tracy I. Storer.

(Contribution from the Museum of Vertebrate Zoology of the University of California.)

It is a general belief among naturalists and well informed laymen that the California Mountain Lion (*Felis oregonensis*) does not ordinarily attack human beings. This belief is strengthened by the experience of many thousands of people who have camped and lived in the range of the mountain lion in this state without being harmed in any way by the species. In fact there is, for California, so far as the writer is aware, only one recorded instance in which a mountain lion has without obvious provocation attacked a human being. This occurred in Quartz Valley, Siskiyou County, on June 19, 1890, when a seven year old boy was set upon and killed by two lions while he was playing among the foothill oaks at some distance from his home.* Children are believed to be slightly more subject to attack by lions than grown persons. Captive mountain lions in Yosemite Valley some years ago were observed to watch children intently even when the latter were at some distance, whereas adult people under similar circumstances aroused little or no interest on the part of the lions. The mountain lion, instead of seeking out people, usually carefully avoids them. Very few people even so much as catch sight of one of the animals.

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*Outdoor Life (Denver, Colorado), vol. xxxvi, no. 2, August, 1915, pp. 162-163.

The above general remarks are given to indicate the ordinary relations between mountain lions and human beings. There is, however, at least one instance in California where a mountain lion, evidently infected with rabies, voluntarily attacked and was responsible for the death of two persons, including one adult. This occurred near Morgan Hill, Santa Clara County, in 1909. So far as known, this case has never been made a matter of record save in the local newspaper. It has seemed desirable to ascertain and record the facts as fully as possible, and for that purpose, the writer, acting in the capacity of compiler, has gathered the available information and herewith presents it to the readers of CALIFORNIA FISH AND GAME.

The first account of this attack appeared in the *Morgan Hill Times* for July 9, 1909 (Vol. XI, No. 8), and the article is reproduced here verbatim with the exception of a final paragraph which was only of local interest.

"The people of Morgan Hill were greatly shocked about four o'clock Tuesday afternoon, [July 5, 1909] when the news reached town that Miss Isola Kennedy had been attacked by a mountain lion on Coyote creek and seriously injured. Dr. J. T. Higgins was summoned and hastened with all speed in his automobile to her assistance. He dressed her wounds as well as was possible with the appliances at hand, and she was brought to her home in town on a cot on a wagon by her father who had also been summoned. It was nearly eight o'clock before they reached home with her as they had to drive very slowly on account of her serious injuries. She was made as comfortable as possible for the night.

"Early Wednesday morning Dr. Higgins assisted by Dr. F. W. Watt, made a thorough examination of the wounds and dressed them. One ear was completely eaten off, the other ear badly lacerated, and a three-cornered cut by the right eye laid the bone bare but left the eye ball uninjured. Her left arm was fearfully mangled from bites and scratches, there being about fifteen deep gashes extending from the shoulder to the wrist and nearly a hundred lacerations from the teeth. The right arm, leg and back were also badly torn. While she is very weak from loss of blood and has suffered great pain, the doctors think she will recover unless blood-poisoning sets in.

"Miss Kennedy had gone out for a drive and picnic on the creek about four miles east of Morgan Hill with Henry Merkle, a ten-year-old boy from Fruitvale, who is visiting the family and Curtis Lane, who is about the same age. These boys with another lad, Earl Willson, were bathing a short distance above the bridge when a lioness attacked the latter boy, striking him with her claws and tearing an ugly wound in the scalp and ear. Miss Kennedy ran to his assistance, when the animal jumped upon her, knocking her down. It then tried to bite her neck, but Miss Kennedy protected her neck as well as she could with her left arm and fought heroically by jabbing the lioness with a hat pin.

"The boys ran to the tents of the Bay Cities Water Company, which are a few yards below the bridge and called Jack Conlan. He grabbed a shot-gun and ran to the relief. He fired two shots into the beast but the shot were too fine to do much injury and the animal clung to Miss Kennedy, gnawing at her arm. Conlan then ran and secured a rifle and shot the animal through the body near the heart, but not until he shot it through the head would it let go its hold. It measured eight feet in length.

"The attack seemed particularly strange as there were a number of persons in the vicinity and several houses are not far distant. It has long been a favorite picnic and camping ground and such a danger was undreamed of."

A request for details in the case sent to Dr. J. T. Higgins, M.D. (now residing in Watsonville), brought the following reply under date of December 20, 1921:

"It is a pleasure for me to endeavor to give you an accurate account of the Isola Kennedy case; inasmuch, as I have read a great deal concerning the attacks of mountain lions on human beings and find that in such cases the animal is generally not in a normal condition, as was verified by this particular case. In talking with old mountaineers and cattlemen I have learned that dogs and horses bitten or scratched by mountain lions usually die.

"In this particular case Miss Kennedy was walking along the bank of the Coyote Creek, near Morganhill, when she saw the lion leap from the bank and attack some boys bathing in the water. Two of the boys escaped, but the third one was knocked down into the water by the lion and scratched on the scalp. Owing, probably, to the boy being knocked into the water the lion abandoned him and jumped to the bank and attacked her, she having come at this time to where the boys were.

"The lion held one of her arms in its mouth during the entire attack, the severe lacerations of her scalp and face being done by its front claws and those of her legs by the rear feet of the animal. She was knocked to the ground and laid in this position endeavoring to kill the animal by sticking a hatpin into its heart, which she was unable to do on account of the toughness of its skin. After considerable time help came to her and the animal was killed.

"Examination showed the lion to be a female, but the report that she had young was probably erroneous as there was no active mammary gland development and no young were seen in the vicinity.*

"Miss Kennedy through loss of blood was very much weakened, but made an apparently uneventful recovery, the lacerations being nearly healed. She was considered convalescent and had been out riding up to about seven weeks from the time of the injury when she developed hydrophobia and died, being sick about one week. The case was seen by three other competent physicians, who pronounced it hydrophobia.

"An autopsy performed upon Miss Kennedy's remains failed to show pus in any part of the body, even the original wounds being healed and there was at no time during her illness any reason to believe that it was septicemia or tetanus.

"Regarding the boy [Earl Wilson], who was scratched while in the water, wish to say that I made only a temporary dressing, when he returned to his home in Santa Cruz. The cause of his death was pronounced by the attending physician in Santa Cruz as tetanus, but judging from the character of the wound and the treatment it received in my office and the period of incubation I do not believe that it was tetanus, but am thoroughly convinced that it was also hydrophobia.

"I believe I am in a better position to have a knowledge of this case than any one else as I was in constant attendance and gave it the closest attention and will be glad to give you any further details you may desire.

"Yours very truly,

(Signed) "J. T. HIGGINS, M.D."

A similar inquiry to Dr. D. A. Beattie brought a letter in which he referred to Dr. Higgins as being able to give the fullest account of the case. The following paragraph from Dr. Beattie's letter is important:

"I will say that as a consultant I saw her more than once, and I also performed the postmortem upon her. But, through the very great negligence of the doctor who took charge of the brain it was not sent to the laboratory until it had become useless. There isn't any question but this was a case of hydrophobia. There were perfectly typical symptoms, and the whole case was a picture of hydrophobia."

It may be said in explanation of Dr. Beattie's closing statement that the early symptoms of rabies (hydrophobia) and tetanus (lockjaw) are somewhat alike, and physicians sometimes have difficulty in distinguishing between the two. There is, however, one difference which marks the courses of the two diseases. A fatal case of tetanus usually terminates soon after the infection is acquired. Rabies, on the other hand, may be very slow in claiming its victim. The rabies infection travels slowly from the point of the bite along the nerves to the brain and then (in the absence of preventive treatment during the intervening time) terminates fatally.

According to the descriptions of the attack furnished above, Miss Kennedy's scalp and facial wounds were caused by the claws of the mountain lion. The lion attempted to bite her neck but she put up her arm and this the lion seized in its mouth. The infection, in a rabid animal, is carried in the saliva and on the teeth, and Miss Kennedy's infection was therefore received in her arm, probably her forearm. The head wounds were harmless from the standpoint of rabies. Had the lion bitten her anywhere on the head she would in all probability have died within a month. As it was, the infection was about seven weeks in travelling along the nerves of her arm and reaching the brain. With our present knowledge of rabies and our facilities for giving the Pasteur anti-rabic treatment, such a case, with early treatment, would stand every chance of escaping a fatal issue.

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*Mr. Conlan also states that the lioness had no kittens.

Rabies was first reported in California in 1898 when there was a small outbreak among the dogs of Los Angeles County. Another small epidemic is on record as occurring at the Soldiers' Home near Los Angeles in 1906. In 1909, the year of the mountain lion attack here described, there was a severe outbreak in several of the counties of southern California, and in the years immediately following there were epidemics in several counties in the San Joaquin Valley, but none in the coast counties so far as can be ascertained. The question of the source of the infection in the mountain lion remains a mystery.

According to the records of the California State Board of Health rabies has been detected in the following animals in California: Horses, mules, cattle, sheep, goats, hogs, domestic cats, dogs, bobcats and coyotes, and once each in the ground squirrel and gray fox. No skunks have been found positive for rabies in California.

The account given above indicates that to the species of animals now known to carry the rabies infection must be added the mountain lion through the occurrence of but one authenticated case would suggest that in this species the infection is rather uncommon. The point to be made here is that any person attacked by a mountain lion in any way should take steps to consult a physician who can determine whether there is any danger of rabies and whether preventive treatment should be started. As first aid treatment wounds made by the teeth of a lion should be cauterized with nitric acid. If the lion is killed its entire head should be packed in ice and sent at once to a county or state health officer with a request that an examination for rabies be made.

In conclusion, then, let it be emphasized that there is extremely little danger of attack from a mountain lion in California. The case here presented is only the second attack, and the first due to rabies, that has come to our attention. With the various epidemics of rabies in different counties of the state, and with the extensive epidemic of this disease among the coyotes of northeastern California, no intimation of rabies infection in mountain lions was obtained. The danger then from mountain lions in California is negligible as compared, for example, with that from the domestic dogs which roam our city streets and country roads.

Berkeley, California, January 29, 1923.

CALIFORNIA'S LARGE GAME ANIMALS—Continued.

By M. Hall McAllister.

To come nearer home—the several species of large mammals found abundant in California one hundred years ago, were several kinds of bear, deer, elk, antelope, and mountain sheep.

Deer and black bear are still here in fair abundance, but the large grizzlies are gone never to return; also both elk and antelope, being inhabitants of the level plains country, would have entirely disappeared if special efforts had not been made to prevent their extermination.

The elk species was principally represented by vast herds of valley elk also known as tule elk. When the miners arrived in California in the 40's and 50's one of their chief sources of meat supply was from the great herds of elk living in the interior valleys. By the early 70's these large numbers had disappeared and the great cattle breeder, Henry Miller of the firm of Miller and Lux, practically saved this species from extinction by protecting the small remnant consisting of a few pair on his ranch in Kern County.

At present there are about 400 valley elk of which some 300 are in two herds near Buena Vista Lake. The remaining 100 comprise small bunches which were caught up and distributed through the state by the California Academy of Sciences. These are in Yosemite Valley, Monterey Peninsula, and various parks and ranches throughout California.

The next most interesting species is the antelope, which would have become extinct some years ago except for the efforts of the societies mentioned at the beginning of this article. There are, at present, probably a minimum of 500 and a maximum of 800 head of antelope in California. The largest gathering is in eastern Lassen County, variously estimated at from 400 to 600 head. The Academy's special herd is at Mount Dome in Siskiyou County, living on the old Modoc Lava Beds and now totaling 120 head. A census of antelope made by the Academy in 1922 gave a total of 434 head, so today (March 1923) there are possibly 500 in all.

The last species, the mountain sheep, is in a class by itself. These splendid animals formerly ranged throughout the entire Sierra Nevada Mountains from the most northern to the extreme southern boundary of the state and were particularly abundant on Mount Shasta and on the Modoc Lava Beds in Siskiyou County. Today they exist only in the Southern Sierra and the desert ranges of Southern California. Here we hope they will always remain. Being protected by law and also by the forbidding and desolate country which they inhabit strengthens their chances of survival. The small herds found fatherest north in the Sierra are about fifty miles south of the Yosemite Valley on Mt. Tom, Mt. Baxter, near Rae Lakes, which are northeast of Sequoia National Park. A total census would show probably about 500 head of mountain sheep in California, divided among the ranges surrounding Death Valley and Inyo County, also small bands on Mt. San Jacinto and Mt. San Antonio, overlooking the Cajon Pass on the west.

Game Warden E. H. Ober of Big Pine, Inyo County, made a collection and observation trip from November 15 to December 15, 1922, in the Death Valley mountains and bagged about ten head for the

United States National Museum under permit from the State Commission. He actually counted 155 sheep in about three weeks time and estimated some 300 head as inhabiting those mountain ranges.

It is to be hoped, by reason of the work done and the publicity given by the societies interested, that these valuable and interesting species of big game, the elk, antelope and mountain sheep will always remain with us and be an asset to coming generations.

SARDINES ABUNDANT NOW—BUT WHAT OF THE FUTURE?*

By Elmer Higgins.

The sardine season of 1922-23, just closed at San Pedro, has been generally successful, the fish having been abundant and of high quality. But this is not indicative of the future, for investigations at the State Fisheries Laboratory indicate that great variations in the annual sardine supply may be expected—that future seasons will not be uniformly successful. Studies made during the present year, confirming previous years' results, show that not every year is favorable to the production of a large crop of young sardines, and that a year of abundant spawning may be followed by a period of several years duration in which but few sardines survive the dangers and hardships of infancy. Thus far, in the brief history of the industry, packing operations at San Pedro have depended chiefly upon the progeny of but three or four years of successful spawnings, although fruitful years have fortunately occurred frequently enough to provide an abundant supply of fish. But should the interval of poor years be long enough for an abundant year-class to be exhausted by fishing and old age, the shortage of raw material would become acute.

But the possibility of great fluctuations in the abundance of our sardines is not surprising when the histories of other great fisheries are considered. Thus, the fishery for the French sardine, the nearest relative of our own fish, has from earliest times been subject to years of depression so severe as to reduce whole fishing districts to extreme poverty, relieved only by public and private charity. In recent times the total yield of the French sardine fishery fell 82 per cent from 1896 to 1903. From 1903 to 1907, the yield remained low and a ''crisis'' again occurred from 1911 to 1913 in which the yield was about half that of the intervening years.

Similar variations in supply in the herring fisheries have been carefully studied by the Norwegians who have offered strong evidence that a great increase in supply was due to the abundant progeny of a single year's spawning. Thus, the take of the ''fat herring'' fishery in the Nordland district of Norway increased one hundred times from 1905 to 1909, due chiefly to the abundance of fish hatched in 1904, and the ''spring herring'' fishery from 1908 to 1911 almost doubled in quantity from the same cause. Like fluctuations have also been observed in the cod fisheries of Europe, and it is only natural to inquire of the existence and the nature of changes in our own fisheries which may have such far-reaching effects upon our economic life.

The existence of great fluctuations in supply in our sardine fishery has been discovered, but the comforting part of this otherwise gloomy outlook is that the same investigations which revealed the uncertain state of affairs provide a means of foretelling an impending period of shortage or abundance one or more years in advance, so that the prudent canner may take advantage of the natural conditions over which he otherwise has no control. An understanding of the changes in the sizes of fish taken in different seasons has been worked out, based upon a knowledge of the existence of one or more dominant (abundant) size-groups, the ages of these size-groups and their rate of growth. Hence, with continued and extended observations of the season runs, one will be able to predict in advance the *character* of future runs as to the relative abundance of the different sizes or age-classes, and in general, the parts of the season during which each size-group will appear in the fishing district. Furthermore, a shortage of sardines due to the passing of a dominant year-class may be distinguished from a shortage due to overfishing of the supply, thus providing a basis for intelligent efforts at conservation and making rational legislative control of the industry possible.

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*California State Fisheries Laboratory Contribution No. 38.

Although these and other results of the sardine investigation are clear cut and as reliable as four years' records permit, it is not appropriate in such a brief note to make an unreserved prediction of the character of the 1923-24 sardine season, for any such statement, unqualified, might prove misleading. The forthcoming report, however, will present the full record of observations enabling one to judge the validity of the conclusions. Any means, however adequate, of judging the future is of great importance, for the sardine industry in California may thus be carried a step further from the present uncertainty and be placed upon a surer basis more nearly on a level with other business enterprises.

PENDING FISH AND GAME LEGISLATION.

Reference to the Senate and Assembly Semifinal History, published after adjournment for the constitutional recess, showed that forty-five bills relating to fish and game had been introduced in the senate and forty-one in the assembly. Is it any wonder that fish and game laws become more and more numerous and more and more complicated? Some of the bills that, fortunately for conservation, have regularly been buried in committee, are on deck again, notably the one providing for bounties on predatory birds and mammals. Some freak legislation is also discoverable, among such being A. B. 920, introduced by Mr. Noyes, providing for a license of $1000 to be imposed upon any person "who is a member of a gun club or otherwise interested in any hunting preserve organized for the purpose of hunting or shooting upon game preserves or enclosed grounds." As in the past, numerous selfish special privilege bills, those providing for longer open season or larger bag limit in local areas, are in evidence.

The following outline will provide a synopsis of the more important bills placed before the legislature:

Senate Joint Resolution No. 6, memorializing congress "to modify the migratory bird treaty with Great Britain so as to allow the legislatures of the various states to provide different dates for the hunting of migratory birds, and "to allow the sale of such birds, in case more are bagged by any one hunter than he can make use of."

Senate Joint Resolution No. 14, asking for a codification and compilation of the fish and game laws of the state.

A. B. 249, prohibiting any public officer of the law from searching a private home, even under legal authority. This, of course, would make law enforcement exceedingly difficult.

S. B. 64, prohibiting aliens from "taking for sale or profit, fish of any kind."

S. B. 65, establishing the King's Peak Game Refuge in Humboldt County, and A. B. 466, providing for a game preserve in Los Angeles County.

S. B. 130, creating a special district for trout fishing in Humboldt County.

S. B. 213, reducing the black bass limit on Clear Lake to ten per day and adding one month to the present close season for the sale of catfish. Passed and signed by the Governor, April 24.

S. B. 214, providing for a one buck limit on deer.

S. B. 215, providing for a general open season on deer from September 15th to October 15th, with an earlier season of August 15th to September 15th, in Districts 2, 2½, 3, 4 and 4¾.

S. B. 251, prohibiting the use of nets to catch striped bass for six years but allowing hook and line fishing. Taking all protection from shad and leaving out possession of striped bass, making the law unenforceable.

S. B. 295 and 511, reducing the limit on quail in proposed District 4¾ (San Diego and Imperial counties), from fifteen to ten per day and closing season on mountain quail.

S. B. 302 and S. B. 508, amending section 626*k* of the Penal Code regarding the sale of ducks and geese, so as to make Federal law and state law correspond. S. B. 302 passed and was signed by the Governor on April 24.

Companion bills A. B. 324 and S. B. 581, providing increased protection for striped bass by giving sixteen more days of close season during the last of May and giving protection to all striped bass of more than ten pounds in weight.

S. B. 334, giving total protection to all tree squirrels until September 1, 1925.

S. B. 361, eliminating drag nets in District 19 in southern California and prohibiting the use of lampara and round haul nets in the taking of barracuda; also prohibiting the use of purse nets with a mesh of more than 4½ inches.

S. B. 363, amending the bounty law to provide a bounty of $100 on each mountain lion.

S. B. 405, relating to the drying of shrimps and to season and size limit of spiny lobsters and crabs.

S. B. 409, providing for increased protection for salmon by elimination of nets in the Sacramento River above the M Street bridge, Sacramento.

S. B. 436, regulating the type and mesh of nets and providing for a close season on salmon during the months of June and July.

S. B. 515, providing against the waste of fish in inland waters by making it a misdemeanor not to use or dispose of such fish for human consumption.

S. B. 527, relating to the protection of mountain sheep, and providing for an open season and the issuance of a $100 hunting license, together with a tag system.

S. B. 544, increasing the citizen's hunting license to $2 and the fishing license to $2, with a combination resident citizen's hunting and fishing license at $3.

A. B. 33, taking away from county clerks the 10 cent fee allowed for the sale of hunting and angling licenses.

A. B. 599, prohibiting the use of a "long gun" or any shotgun capable of carrying more than six shotgun shells.

A. B. 693, providing for the securing of public shooting grounds through a fund to be obtained by an additional fee of 50 cents levied upon each applicant for a hunting license. The Director of the State Department of Agriculture is empowered to secure safe titles or to accept gifts of land suitable for public shooting grounds. Administration of said public shooting grounds to be in hands of Fish and Game Commission.

S. B. 694, providing for a single-headed Fish and Game Commission, the Commissioner to be appointed by the Governor and to hold office at his pleasure. The salary is fixed at $5,000, and A. B. 1095, providing a salary of $4,000 to the president of the Fish and Game Commission who shall also be the executive officer. Two other commissioners are allowed a per diem of $10 and expenses.

A. B. 695, increasing the penalty for infraction of fish and game laws by prohibiting a convicted person from hunting or fishing, or both, for a period of twelve consecutive months after conviction.

S. B. 696, relating to fish reduction, originally setting the limit at 10 per cent, but later amended to allow unlimited use of sardines for the manufacture of fish oil for human food during the four months when the fish contain the greatest percentage of oil and limiting the use in reduction plants to 10 per cent during the rest of the year.

A. B. 764, prohibiting the use of dogs in hunting deer.

A. B. 765, providing that one-fourth of all hunting license funds shall be diverted to a game bounty fund, and A. B. 770, providing for bounties on coyotes, wolves, wildcats, skunks, weasels, raccoons, mountain lions and gray foxes.

A. B. 858, providing for the issuance of indentification tags with each hunting license, which tag licensee is required to display on the outer garment, on the back between the shoulders, in such a manner that such figures are plainly visible at all times while hunting.

A. B. 859, requiring that hunters must make statement of game killed during previous year when applying for license.

A. B. 862, amending the section of the Penal Code relating to the protection of deer in such manner as to provide protection for forked-horn mule deer whose horns commonly fork when one year old.

A. B. 919 and 1258, removing protection from the black bear.

Among the more interesting bills relating to angling are the following:

A. B. 1272 prohibiting the use of salmon eggs as bait. Similar bills have been before at least three previous legislatures.

A. B. 768, prohibiting the use of more than three hooks in the taking of fish in any lake or stream.

S. B. 412, prohibiting the taking of fish within 250 feet of any fishway, or within 150 feet of the lower side of any dam, or within 150 feet of the upper side of any stream, and providing penalty therefor.

Amendments to the fishway law were provided for in S. B. 548, and 678. Several other bills providing for minor changes in the protective laws for steelhead and for trout were introduced.

Outstanding among the bills relating to commercial fisheries are A. B. 1001, prohibiting the use of nets in the Sacramento River above the Rio Vista bridge, and in the San Joaquin above the mouth of the Mokelumne River, and S. B. 436, giving the same increased protection to salmon.

FIG. 14. Mother black bear and cubs, Yosemite National Park.

A. B. 225, limiting the issuance of permits for fishing to citizens who are bona fide taxpayers and several bills giving increased protection to the striped bass are noticeable. Amendments to the laws regarding nets are to be found in S. B. 361, and S. B. 409.

A. B. 692, providing for night fishing for striped bass.

A. B. 826, making eligibility for citizenship a requirement for the taking of fish and shellfish of any kind whatsoever.

A. B. 792, amending the section relating to the shooting from moving boats and prohibiting shooting from scull boats in Fish and Game Districts 1½, 7 A, 8 and 9, with the exception of shooting hours on Wednesdays and Sundays. It is defective in that it omits prohibition of the use of automobiles and airplanes in hunting, and the use of boats in hunting of whales. Defects eliminated and passage recommended on April 27.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

MAY 23, 1923.

"A hunting or a fishing license is a special tax, levied against certain individuals who enjoy an occasional day afield. They pay for the privilege of hunting or fishing, as the case may be, and every cent of the money that they pay in should be devoted to conservation work and should not be mingled with the general funds of the State."

BUDGET RECOMMENDATIONS.

No matter what may have been the fate of the budget recommendations prepared for the present session of the legislature, by the time our readers receive this issue of CALIFORNIA FISH AND GAME, it is a matter of history that certain recommendations affecting adversely conservation work were made, and it is only fair that every hunter and fisherman should know the facts.

The outstanding feature of the budget, as it applied to fish and game administration, was that it provided for the placing of over a half million dollars, a sum equivalent to 45 per cent of the estimated income from hunting and angling license fees, in the general treasury during the coming two years. Heretofore, all hunting and fishing licenses have been placed in a fish and game protection fund and have been used solely for the support of fish and game conservation work. This provision in the budget seems the more remarkable in that the Supreme Court has ruled time and time again that a state can not license for revenue, but solely for regulation. The only reason why the license system is not termed class legislation is because the funds are used in a regulatory system which benefits those taxed.

Judging by the long-drawn-out debate during the session of the legislature, the budget law, passed by the people at the last election, placed the state's finances in a muddle. No one has apparently been able to solve the problem as to whether the budget law, as enacted, took in the self-supporting commissions. Much argument has not cleared the situation and probably a Supreme Court decision is the only thing that will actually settle the matter.

Certain it is that if the Fish and Game Commission is to continue to receive support from private individuals it must be able to utilize the license fees. If any of the license fees should be appropriated for other state functions, those persons who in the past have donated hatchery sites, water rights and lumber, and the railroads, which furnish free transportation, would certainly withdraw their support. As matters have been, every man who has paid a dollar for a license has had the satisfaction of knowing that his dollar was used wholly in fish and game preservation. Automobile license fees are used for the building of good roads and each owner pays his license with good grace. Likewise, the angler willingly pays his dollar because he knows that his money goes into law enforcement and the stocking of streams. Divert these funds to other channels, and the whole system breaks down. Such has been the stand taken by all. Not only did chambers of commerce, fish and game protective associations and other organizations demand that all license fees be retained in a fish and game protective fund, but the legislature itself consistently refused to vote an increase in hunting and angling licenses until it was definitely known that all such increased funds would be applied for fish and game protection and conservation.

The wild life resources of California are becoming increasingly attractive to people all over the world. Every year the number of hunters and fishermen increases. It is only reasonable, therefore, that more funds be made available for use in conserving this valuable resource. Whereas, a few years ago it was estimated that at least $25,000,000 was being spent annually because of the abundance of fish and game, yet in recent years this sum has probably been exceeded. No other natural resource brings such great dividends in money, food, health, pleasure and happiness as do the state's fish and game resources. Those who make use of these resources have been the only ones that have paid for their administration, and they rightly demand that every dollar of income should be utilized in administering and regulating this resource.

What will come next? At the 1921 session of the legislature, a fight had to be made to save fish and game protective funds from being used for the building of tuberculosis hospitals, a worthy cause, but an unjust source of income. In the past session it has been necessary, not only to fight for the funds allotted to conservation, but also to fight for actual existence and a chance to render service. We wonder what will be demanded of friends of the work two years hence. Certainly, the safety of wild life conservation work is more and more dependent upon those who hunt and fish, those willing to fight for a cause.

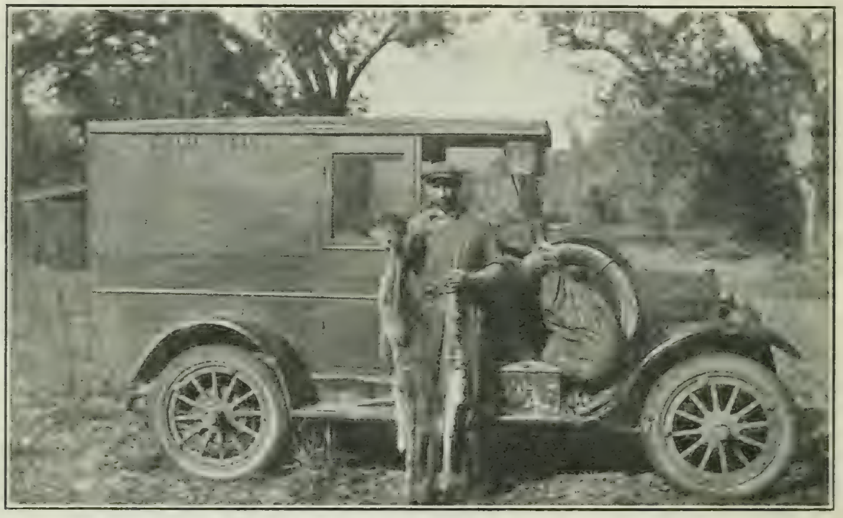

FIG. 15. State lion hunter, Jay Bruce, with skins of one of his lions. Mr. Bruce averages more than thirty lions a year.

Adequately to conserve wild life resources by every means at hand, to plant and restock depleted waters and game covers, and, meanwhile, to render a full dollar's worth of service for every dollar spent—this has been and ever will be the aim of the Fish and Game Commission.

CONGRESS KILLS GAME REFUGE—PUBLIC SHOOTING GROUNDS BILL.

As is so often the case, it appears to take time to put a good bill through Congress. The Game Refuge—Public Shooting Grounds bill, which was passed last fall by the Senate, was defeated on February 13th, by twenty votes in the House. Those conversant with the situation maintained that the unfortunate time when it was brought to the floor resulted in the unfavorable vote. Unfortunately, game will have to wait another year, at least, before obtaining the increased protection afforded by the bill, and those who have actively espoused the measure will have to begin the campaign all over again with the convening of a new Congress.

HIDING BEHIND THE FARMER.

Surprisingly often those who are anxious to shoot protected birds attempt to cloud the issue by pointing out damage to crops and hiding behind the farmer. Witness the ducks vs. rice situation of the Sacramento Valley where it was shown that rice growers themselves were not interested in accepting the proffered help of hunters in relieving them of depredations by ducks. Witness the geese vs. grain situation in Tulare County a few years ago where again it was shown that it was the hunter, rather than the farmer, who exaggerated the damage in grain fields. Witness the following petition relative to band-tailed pigeons sent the United States Department of Agriculture by residents of northern Santa Barbara County:

Santa Maria, California,
December 30, 1922.

To the Honorable
Henry Cantwell Wallace,
Secretary of Agriculture,
Washington, D. C.

We, the undersigned, respectfully petition the Honorable Secretary of Agriculture that an open season be declared for killing wild pigeons in Santa Barbara County, California.

The conditions are extraordinary and warrant the killing of wild pigeons in said county for the reason that during the months of November and December, 1922, the flight of wild pigeons has been unusual in numbers of pigeons and disastrous to the acorn crops of the hog ranches and the early grain crops of the farmers. The extraordinary flight has continued daily and will continue through January, February, and probably March of 1923.

The continuous flight consists not of hundreds but of thousands of pigeons daily, estimated at over ten thousand pigeons daily, and they confine themselves largly to the territory in Santa Barbara County lying north of the Santa Ynez River.

The pigeons are greedy feeders and they are devouring and destroying the acorn crops, in the oak forests. Hog raisers depend upon the acorns for hog feed, and the loss is a serious one.

The farmers are unable to plant their grain because the thousands of pigeons devour it as soon as it is sowed. This is causing direct loss and serious damage to the farmers.

We urge an immediate opening of the season for the killing of pigeons during the months of January, February and March, with a limit of fifty birds per hunter, with no limit on farming land where permission is secured from the farmers.

We urge that an immediate investigation be made by telegraphic communication with the California Fish and Game Commission, Sacramento, California, and through H. J. Abels, County Game Warden, Santa Maria, Santa Barbara County, California, and that open season be declared immediately.

(Signed by 18 persons, all but two listed as farmers.)

An investigation by Dr. W. P. Taylor, Assistant Biologist of the United States Biological Survey, resulted in a report as follows:

"The petition is based on a misconception, not to say willful perversion, of the facts. As noted in my report herewith, no damage, this year, to grain could be found or was reported either in the Santa Maria pigeon section or anywhere else in the pigeon country. Many acorns were left behind by the pigeons in the Santa Maria section; there is abundant green feed this year aside from acorns; and the value of acorns as food for stock is of questionable value at best, for it is reported on good authority that hogs fed on acorns put on soft fat and lose their marketability, and that acorns often cause abortion in cattle.

"The killing motif behind the petition becomes apparent in the next to the last paragraph, in which an immediate opening of the seasons is urged for the killing of pigeons during the months of January, February and March with a *limit of fifty birds per hunter*, with *no limit on farming land where permission is secured from farmers.*

"The granting of this petition (if it were possible), would pave the way for a duplication of the disgraceful slaughter of 1911-12, which is still a stench in the nostrils of conservationists, as well as in those of the better balanced residents in the pigeon sections themselves. I talked with numerous petitioners, but not one, on conversation, argued for the large limit here proposed, or for unlimited killing on farm lands. On the contrary, several of the petitioners distinctly opposed permitting slaughter like that in 1912."

The deputy fish and game commissioner of the district reports as follows:

"The movement for an open season on wild or band-tailed pigeons a few months ago in this section was principally brought about by some of the Santa Maria sportsmen, assisted by a few cattlemen and farmers in the vicinity of Zaca and Los Olivos.

"As to damage, will state that there is no question in my mind but what the pigeons have in the past done harm to the farmers in the Zaca, Los Olivos and Santa Ynez valley sections so far as grain and wheat crops are concerned, but not nearly as bad as reported. As to the acorns, will say that I have talked to cattlemen and they do not think much of the acorn as a food for cattle and hogs. The reason I am mentioning the acorn is because it was also made an issue in connection with the matter of damage caused by pigeons."

If it is time to open the season on wild pigeons let the sportsmen so state, proving their contention by a show of statistics as to augmented numbers of birds and reasonableness of a toll being taken. *But why hide behind the farmer?*

VIOLATIONS OF PIGEON LAW NUMEROUS.

We leave our readers to decide whether there could have been any possible connection between the roundup of violators of the law giving protection to the band-tailed pigeon as evidenced by the following case reports of Deputy H. J. Abels of

Santa Maria and the petition to the United States Department of Agriculture given above:

December 24, 1922, arrested G. W. Fryman, of Whittier, Cal., for a violation of section 626, hunting and pursuing wild pigeons, and on a plea of guilty, December 26, 1922, in the local Justice's Court, Judge L. J. Morris, Santa Maria, Santa Barbara County, Cal., fined the defendant $25, which he paid.

December 24, 1922, arrested B. Davis, of Los Olivos, Cal., for a violation of section 626, hunting and pursuing wild pigeons, and on a plea of guilty, December 26, 1922, in the local Justice's Court, Judge L. J. Morris, Santa Maria, Santa Barbara County, Cal., fined the defendant $25, which he paid.

December 24, 1922, arrested R. N. Hobbs, of Lompoc, Cal., for a violation of section 626, hunting, pursuing, taking, killing, destroying and having in possession one wild pigeon, and on a plea of guilty, December 27, 1922, in the local Justice's Court, Judge L. J. Morris, Santa Maria, Santa Barbara County, Cal., fined the defendant $50, which he paid.

December 24, 1922, arrested A. B. Wurz, of Los Alamos, Cal., for a violation of section 626, hunting, pursuing, taking,

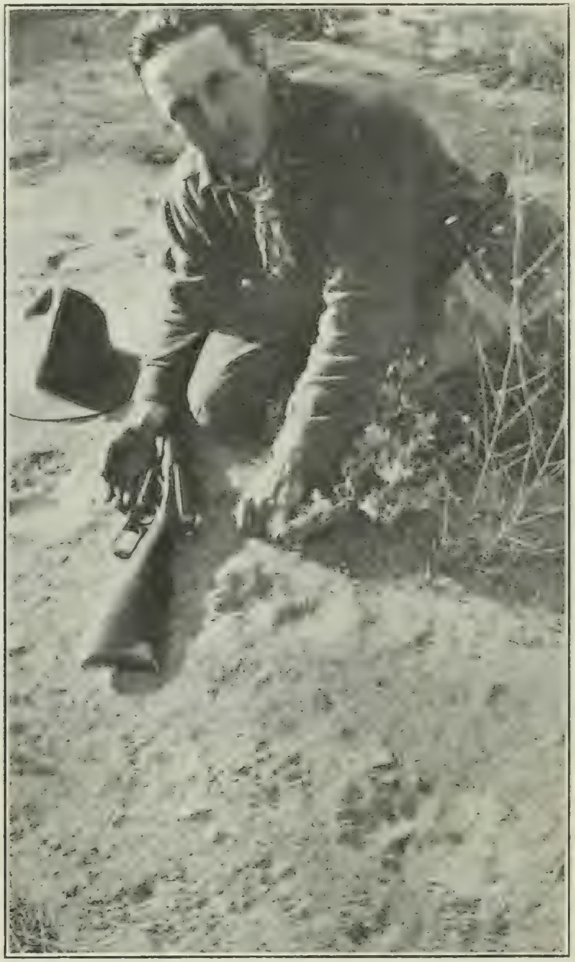

FIG. 16. Bruin left his footprints in the sand. Note the size as compared with the human hand. John Edwin Hogg, who is shown in the photograph, wears a No. 7 glove. Photograph taken in Tulare County, December, 1921.

killing, destroying and having in possession one wild pigeon, and on a plea of guilty, December 27, 1922, in the local Justice's Court, Judge L. J. Morris, Santa Maria, Santa Barbara County, Cal., fined the defendant $50, which he paid.

MANY DEFEND BLACK BEAR.

The article in the January issue of CALIFORNIA FISH AND GAME by Jay Bruce, entitled, "The Black Bear in Relation to Stock," has drawn many favorable comments from persons who know the habits of the black bear. Typical of the comments is that by A. W. Anthony of San Diego: "I want to place myself on record with Jay Bruce as a friend of the bear. For many years I was on the sheep range of eastern Oregon where black bears were common, and where I had every chance to hear the stockman howl about his loss. I often investigated the matter and have never yet found a clear case of killing by the bear."

CALIFORNIA FOREST FIRE KILLS TROUT.

There was at one time good native trout fishing in Depusquet Canyon located in the vicinity of the Santa Barbara National Forest of southern California. In July, 1914, an intensive fire burned over some 14,000 acres of this canyon watershed. The ash and dry soil carried by the winds of that summer and the following winter filled many of the excellent pools and so choked the flow of the stream as to cause a change in the channel in places. This large amount of foreign material in the waters resulted in the death of the fish, probably in part by clogging their gills, and partly by changes in the temperature and chemical character of the water and the velocities of the currents. It is well known that cool, rapidly moving waters have a maximum oxygen content. Fish developed in such waters under normal conditions may be seriously affected by the sudden lowering of the oxygen content by raising the temperature of the water and clogging the stream flow.—*U. S. Fisheries Service Bulletin, No. 92.* Jan. 2, 1923.

Pertinent to the foregoing note, the February 2, 1923, issue of the *Fisheries Service Bulletin* quotes a writer in the Kooskia (Idaho) Mountaineer, of November 29, 1922, in which two very definite causes of the death of trout in mountain streams, following forest fires, are given. In small streams, he says that the water often becomes so heated that the trout die as a result of the sudden rise in the temperature of the water, the fish being literally "scalded to death" while the fire is raging.

In some of the large streams the volume of water is too great for any such dangerous increase in temperature to occur, or for any great amount of alkalization, due to the leaching of ashes, to take place after rains following the forest fires. In such instances the death of the trout is plainly caused by the large amount of foreign material in the water, drawn into the gills of the fish in the course of respiration. One notable case is cited, that of the Selway River, following the great fires of 1910, in which the fish were found dead in large numbers along the banks of the river. Here, a severe cloudburst visited the basin a very few days after the fire and large quantities of charred wood, particularly cedar bark, were swept into the stream. As the gills of the dead fish were completely covered with the minute particles of the charcoal and the bark filaments, it was clear that these fish had choked to death.

PHEASANTS LIBERATED IN SAN DIEGO COUNTY.

The first liberation of Chinese Pheasants ever made in San Diego County occurred on February 15, when 104 adult birds were received direct from China, having been imported by the San Diego Fish and Game Protective Association. The birds arrived in splendid condition and fifty of them were released at once upon the ranch of Bert Simmons at Japatul. Mr. Simmons is distributing food for them and says that the birds seem to be getting along splendidly. The remainder of the pheasants are destined in equal numbers for Pine Hills and Palomar Mountain, where they will be liberated as soon as weather conditions are favorable. Judging by experiences of other states where Chinese Pheasants have readily become acclimated and have increased in numbers, in spite of being hunted, it is believed that the nucleus has been established in San Diego County, not only of better sport in the future, but also of better conservation of our native game birds, whose numbers are naturally supplemented by the pheasants. Until they have increased sufficiently to warrant an open season, the pheasants are rigidly protected by state law.—*Bull., San Diego Natural History Museum*, March, 1923.

QUINNAT SALMON TAKEN IN LAKE ONTARIO.

The fact that recently a quinnat salmon, heretofore found only in Pacific coast waters, was caught in the Bay of

Quinte, holds welcome promise to sportsmen that the waters of eastern Canada are possibly enriched with a new game fish. It is also the first evidence obtained that the planting of quinnat salmon in Lake Ontario, undertaken by the Canadian Department of Fisheries three years ago, may have been successful. Until this fish, a 3½ pound male in spawning condition, was caught, it has remained a mystery whether the several million fry liberated at that time would adapt themselves to a new environment and thrive in the waters of the lake, or true to the migratory instinct of the species, would find their way to the Atlantic through the St. Lawrence. The lakes and streams in the region of Lake Ontario are regarded as among the finest fishing waters of the entire continent, and the quinnat salmon, considered the best of our several varieties of Pacific salmon and attaining a weight of 18 to 30 pounds or more, would be a worthy addition to the already large list of game fish which furnish sport to anglers in that section.

STRICTER LAWS NECESSARY.

Increasing toll of living plants, insects and animals taken by the recreationists the world over, is leading to stricter and stricter laws for their protection. For some time it has been necessary to protect the edelweiss in Switzerland, as well as several species of butterflies. At the last session of the legislature provision was made for better protection for a much abused native shrub, the Toyon berry. The state of Vermont, noted among New England states for its rare ferns and flowers, has recently awaked to the fact that its flora is threatened with extinction, largely due to the commercial collection of living plants for the beautifying of grounds and gardens. Under the leadership of the Vermont Botanical Society, the first general game law was drawn up and was passed by the Vermont 1921 Legislature. This law provides that a number of rare plants shall be considered on a protected list and may not be collected for commercial exploitation. Even botanists are restricted to two specimens per season to plants named in the list. Similar restrictions on the picking of wild flowers and plants within our National parks have become necessities and it can be expected that future years will bring added restrictions in this regard. Let those who are warring against the ever-increasing number of laws take heed and by their own practice and teaching make added restrictions in this respect unnecessary.

DEER IN RELATION TO CROPS.

The state of Vermont has become famous because of the success attained in bringing back the deer to game status. From a situation that afforded no hunting whatever, this state, by sane protective methods, has increased its herd of deer until the average yearly take approaches the five thousand mark. If other states could have hunting in proportion to that afforded in Vermont, there would be no complaint anywhere. Statistics from the last report of the Vermont Fish and Game Commission show a kill of 4,477 during the year 1920, when two short open seasons of six days each were given the sportsmen. The total weight of deer killed amounted to 590,964 pounds. This, of course, means over 200 tons of highly prized food.

Vermont also claims the distinction of being one of the few states which pays claims for damage to growing crops caused by deer. A comparison of the number of dollars thus paid with the value of the annual kill is of interest. In 1920-21, $576.08 was paid in claims. In 1921-22, $568.67 was paid. Putting a minimum valuation of $30 on each of the 4,477 deer killed, we have $134,310 to compare with these damage claims.

Sometimes complaints in this state would lead one to think that deer are exceedingly destructive to crops, but careful investigations substantiate what has been proved in the state of Vermont, that such damage is greatly exaggerated.

EDUCATIONAL WORK.

Beginning in 1910 the Commission started educational work in the schools. In 1914 a separate department of Education, Publicity and Research was established. Since that time an organized campaign of education has been waged. Methods utilized have been; newspaper and magazine publicity; the issuance of a quarterly publication, CALIFORNIA FISH AND GAME, with the motto "Conservation Through Education"; conservation lectures and displays of motion pictures throughout the state and educational work in the summer resorts where people are particularly receptive to information on fish and game.

The illustrated quarterly CALIFORNIA FISH AND GAME, now in its ninth volume, has been the medium of publication for many important reports and scientific treatises, besides furnishing information on current activities of the Commission. Other series published include Biennial Reports, Teachers Bulletins, Fish Bulletins, and Circulars.

A splendid series of motion pictures are owned by the Commission and are in almost constant use. These films form a basis of many lectures as they emphasize the need of fish and game conservation. Of particular use has been the colored reel showing hatchery operations. The films are furnished free to schools and other organizations making application, provided that they furnish a lantern and capable operator.

The summer vacationist finds himself in close touch with nature, and is in a particularly susceptible mood to receive information on wild life. As a result, the vacation camps and mountain resorts of the state constitute a heretofore neglected opportunity for worthwhile educational work. During the summer of 1919 the Lake Tahoe resorts were chosen by the Commission as a field for work of this kind. Illustrated conservation lectures were given and people interested in living things by means of organized trips afield. The response was very gratifying.

FIG. 17. Duck hunting on the Salton Sea. This inland body of water furnishes splendid shooting for southern California sportsmen. Photograph by John Edwin Hogg.

At the suggestion of Stephen T. Mather, Director of National Parks, operations were shifted to Yosemite National Park in 1920. Here the work was organized along similar lines under the name of "nature guide service." As a result thousands have yearly had an opportunity to study wild life under the instruction of a nature guide and to hear a conservation message from the Fish and Game Commission. During the summer of 1922, 39,000 persons attended lectures on natural history and over three thousand followed nature guides afield to study bird and animal life at first hand. It is obvious that in no other way could so many people be reached in so short a time.

Through educational work, to build a favorable public sentiment with reference to conservation has been the outstanding aim in connection with the summer educational work.

EDUCATION FUNDAMENTAL IN CONSERVATION.

"Most clear to those who have studied the complex problem of perpetuating wild life in Vermont, stands the fact that by whatever method we may proceed to the work, education must be its ground plan and foundation." This is the introductory paragraph to the Twenty-sixth Biennial Report, 1922, of the Vermont Department of Fish and Game. One after another, the states are waking up to the fact that simple law enforcement is not the fundamental method in attaining fish and game conservation. It is quite evident that knowledge of wild life and the conditions surrounding it, imparted to old and young, is the only thing that will establish a sound basis for attaining the end sought. Of course it takes force to educate certain violators, but such violators are in the minority and education for the majority is the important thing.

The importance of making a study of conservation part of the school curriculum is becoming more and more apparent. Praise has been unstinted for Nevada, a state that provides by law for conservation teaching in the public schools. The Fish and Game Commissioners of Vermont go on to state: "Natural History as a study should have a prominent place in primary and preparatory schools in Vermont, and the true use and conservation of fish and game ought to be taught the children from specially prepared textbooks dealing with the subject." So say we all of us.

"LET WELL ENOUGH ALONE" IS MOTTO THAT APPLIES ESPECIALLY TO THE CALIFORNIA FISH AND GAME COMMISSION.

Legislative action often is of the nature of frenzy. There is sometimes an excess of outlay and other times excess of economy. At present there appears to be a tendency to retrench that is extravagant. Undoubtedly achievement may be made in economizing in some departments and commissions. But there is one in which retrenchment is not called for, and that is the California Fish and Game Commission. This commission has always been self-sustaining. It is maintained by fees on licenses issued to hunters and fishermen, canners and commercial fishermen. Its business is not only to conserve but to propagate and expand the fisheries and the game resources. This commission is not only efficiently managed, but it is also conscientiously operated as is proven by the fact that it has not only lived within its revenue, but built up a surplus of some $100,000 in recent years.

It is being proposed that the revenues derived by this commission for its own support shall be thrown into the State treasury and the funds logically belonging to it diverted to departments and commissions that have no connection with the fisheries and game resources. According to the proposed budget a half million dollars will be diverted from fish and game protection and propagation. The sum allotted for the next biennial period is so small that much of the valued research and educational work for which the commission has become famous will not simply be curtailed but entirely eliminated. To all disinterested persons the proposition is entirely illogical. But just the same, frenzy might possibly triumph over logic in this case. As one of the functions of the Fish and Game Commission is to protect, foster and expand the fisheries of California, the commercial fishermen, including the canners, in appreciation of the efforts and achievements of the commission in the past, and because of continual benefits derived, have been contributing a substantial sum yearly to sustain the commission's commercial fisheries work. The railroad companies, realizing that the commission has been making California famous for her game sanctuaries and lake and river fisheries and believing in their work, have recently decided to contribute certain free transportation for distribution and planting of fish. Those who would reduce the Fish and Game Commission organization do not appear to understand that the contributions of the sportsmen, commercial fishermen and the railroads are not likely to be diverted to the State treasury and thence to the building of public buildings, roads, etc., that have no vital connection with the fisheries and game resources, for the very cogent reason that the sportsmen, commercial fisheries and railroads might decline to contribute any further. If the money so contributed should not be devoted directly to the purposes of the Fish and Game Commission for use in conservation, propagation and research, why should the sportsmen, fishermen and railroads contribute?

Clearly, the Fish and Game Commission should be exempted in this retrenchment movement. To reduce the organization would be to hurt its efficiency which is being kept at a high point and which must be kept there in keeping with the importance of the commercial fisheries. The fisheries and game resources of California must be conserved, fostered and expanded, and the Fish and Game Commission has proven that it has the work entrusted to it well in hand. "Let well enough alone."—Editorial *Western Canner and Packer*, Mar. 1, 1923.

DEER CONSERVATION.

I have hunted deer every season, and have always been satisfied with one legal buck. What any man wants with more than one is beyond my power of comprehension. Certainly it's not the meat, for if it's meat one wants, it is cheaper on the markets. I think all the venison I've killed and eaten has averaged about $2 a pound after all the expenses were figured up. For this reason I heartily approve the plan of the Fish and Game Commission to reduce the bag limit to one buck, and the institution of the proposed tag system. My young son will undoubtedly want to hunt some day, and when he grows up, I hope there will still be some game left to hunt.

Not long ago I had a hunting trip after bighorn mountain sheep in the Cocapah Mountains of Baja California. It was a successful trip in every way, but I wouldn't recommend it to any one as a means of supplying their tables with meat that didn't have to be paid for at so much per pound. If figured on that basis, I'd have better eaten some Imperial Valley turkey. I mention this trip into Mexico because I have observed, since I was down there, that the Mexican government has declared a ten-year closed season on deer, bear, and mountain sheep, throughout the republic. It seems to me this is a grave mistake. I question why any such measure should have been necessary in Mexico—certainly *not* through any scarcity of game or overabundance of hunters. I believe that a ten-year closed season will only lead to wholesale violations of the law, with the game just so much the worse off by reason of it. When a country appears to be unable to enforce its fundamental laws against such crimes as murder and robbery, why talk about making new game laws?

I heard a wealthy man make his boast, recently, that he always does his deer hunting out of season, because he fears to go into the hills when some boob hunter is liable to mistake him for a deer. If he gets caught, as he said, it's only a matter of $100 or possibly $250, and he considers that cheap insurance, with premiums that may never fall due, against the possibility of being shot by some other hunter. I hope this fellow connects up with a cheater like himself some day, and gets a .405 caliber soft-pointed bullet through his overfed bay window! This bird goes out and gets two or three bucks any time he feels like it because he's got the money to pay if he's so "unfortunate" as to get caught, while some fellow like me goes out and does it "according to Hoyle," when the deer are not half so easy to get, and takes chances with the "deer hunter," who during the open season sees horns on my hat.

I had this very experience during the past deer season. The pastor of a Los Angeles church, whose name I will refrain from mentioning, let drive four shots at me with a .351 Winchester automatic. No doubt the only reason I am able to write this today is the fact that the preacher was a miserable marksman, who apparently expected to kill his venison by using an automatic rifle and laying down such a barrage that no deer could be expected to live through it. Suffice to say that the reverend gentle-

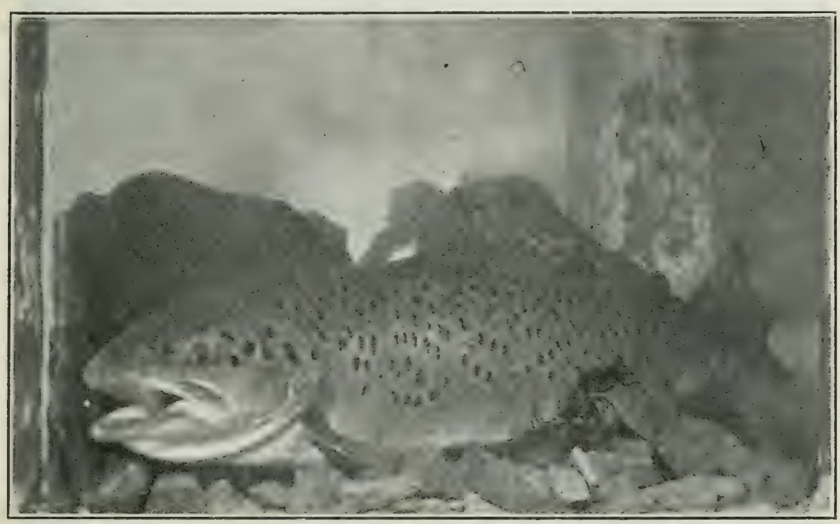

FIG. 18. Land-locked salmon. Not a framed picture, but a live fish in an aquarium at the Mt. Shasta Hatchery. This is the last individual of the species left at any state hatchery. Photograph by H. C. Bryant.

man got a verbal lacing such as he probably never received before. I actually felt sorry for the poor fellow after I got through with him, and finally agreed never to mention his name in connection with it upon the condition that he'd get out of the hills immediately—and stay out, for the rest of the deer season.—John Edwin Hogg, Los Angeles, California.

NON-SALE OF TROUT.

The non-sale of trout law has been instrumental in prohibiting the commercialization of the Tahoe and rainbow trouts. Because of the fact that a number of large steelhead trout are caught by salmon fishermen, it was deemed wise at the time the non-sale law was passed, to provide for the sale of steelhead when so taken. Under certain prescribed regulations, steelhead trout to be seen on the market, which are properly tagged, have been taken lawfully and are being sold lawfully. Many steelhead trout are shipped in from Washington and Oregon. Landlocked sockeye salmon from Washington are also to be found on the market. These are being sold under the name of trout or salmon trout. This provision in the law has made it possible to utilize the steelhead caught by salmon fishermen, and, without endangering the steelhead fisheries, has allowed this one kind of trout to reach the consumer. Let no one on the sight of trout in the market be led to believe that the trout law is being openly violated.

JAPAN INTRODUCES RAINBOW TROUT.

New Zealand and the Argentine Republic have successfully introduced the rainbow trout. Another foreign country is now making efforts to accomplish the same thing. A letter recently received from J. Itani, Director of the Imperial Fisheries Institute in Tokyo, Japan, quaintly describes the success thus far attained.

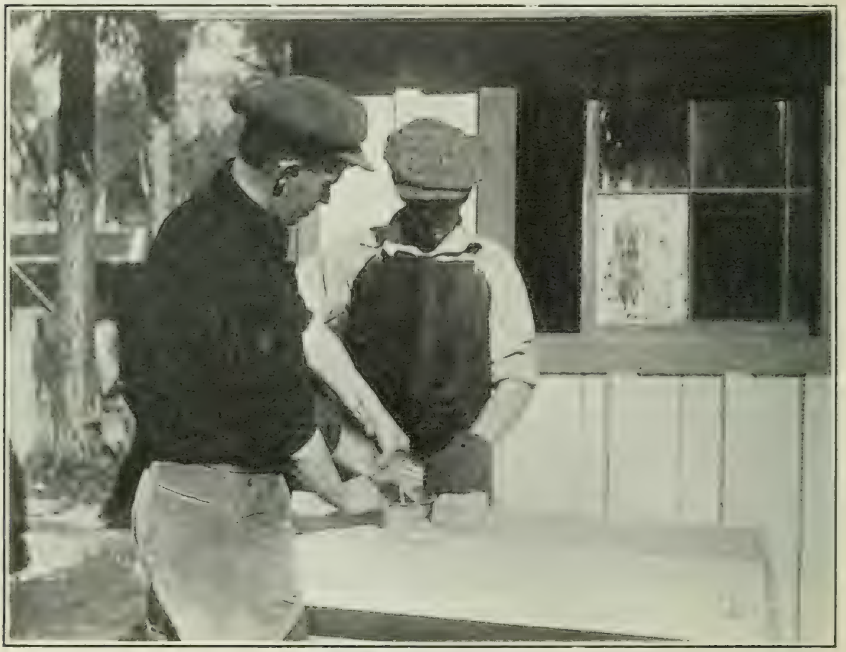

FIG. 19. Spawning Loch Leven trout at the Mt. Shasta Hatchery. Photograph by H. C. Bryant.

"We have the honour to inform you that the rainbow trout which you kindly sent to us in March this year, are now rearing in good condition at the Kizaki Fishcultural Station of our Institute. But, according to disease, the numbers of fingerling have decreased.

"We are anxious we can not have a good result in propagation of the fish by the only first transplantation. We exceedingly intend that we shall have the eggs to transplant continuously."

WOOLGROWERS WOULD BLACKLIST THE BLACK BEAR.

At a fall meeting of the California Woolgrowers' Association a resolution was passed protesting against the depredations of the black bear and calling for a bill to be introduced in the legislature providing for no closed season, and for measures for the extermination of this animal in connection with the act providing for the destruction of predatory animals.

In the last number of California Fish and Game, Mr. Jay Bruce, state mountain lion hunter, presented a convincing argument in favor of the bear. It is a well-known fact that the black bear feeds upon berries and other vegetation, and that it is only individuals that become sheep-killers. That monarch of the forest for which our state is named, the grizzly bear, has already been exterminated, and there is no easier way of accomplishing the same object with the black bear than by taking protection from it. It is to be hoped that some other means of protecting the interests of the woolgrowers may be found, and that the black bear will continue to receive the protection it so needs in this state.

UNDERSIZED TROUT.

There has been much discussion as to the advisability of putting back undersized trout caught on a hook. Some of the best evidence as to whether or not such fish succeed in living has come as the result of experiments carried on at the Bayfield and St. Croix Hatcheries by the Wisconsin Conservation Commission, as reported in the *Wisconsin Conservationist.* About 30 undersized eastern brook trout ranging from 4 to 6½ inches in length were hooked and then carefully removed and placed in a separate pond. Of the 30 fish that were caught at the

Fig. 20. A limit of rainbow trout taken on a fly casting rod by Mrs. John Edwin Hogg from the upper reaches of the Santa Ana River, San Bernardino County. The largest trout weighed about 4 pounds. Photograph by John Edwin Hogg, June, 1922.

Bayfield Hatchery, not one died, and some of them were hooked quite badly. Their recovery followed several days of inactivity, apparently due to injuries made by the hook. At the St. Croix Hatchery 30 undersized trout were caught with a barbed hook and 30 others with a barbless hook. Of the 30 fish that were caught with a barbed hook, 5 died, but only 2 of those taken with a barbless hook died.

These experiments appear to strengthen the attitude taken by many that if undersized fish are carefully removed from the hook they have a good chance for recovery. Certain it is that if the larger fish are most desirable the smaller ones must be left in the stream in sufficient numbers to furnish a supply of larger sized ones.

COUNTY CO-OPERATION.

Several counties have their own fish and game wardens. In some instances the deputy fish and game commissioner receives part of his salary from the county. Los Angeles County boasts of a county forester whose additional duty it is to enforce fish and game laws within the county. That this county is aiding greatly in rounding up the violators is evidenced by the following report for 1922, furnished by Stuart A. Flintham, county forester:

Department of Forestry of Los Angeles County.

Stuart J. Flintham, County Forester.

Game Arrests and Convictions, Los Angeles County, January 1, December 31, 1922.

Arrests	191
Convictions	187
Not guilty	1
Dismissed	3

CHARGES FOR ARRESTS.

Deer—	
Killing a doe	3
Killing a spike buck	1
Illegal possession of meat	3
Illegal possession of hides	3
Doves—	
Over the limit	2
Out of season	4
Quail—	
Out of season	4
Sale of	2
Miscellaneous—	
Killing wild pigeon	1
Ducks out of season	7
Killing non-game birds	6
Hunting without license	17
Transfer of license	1
Shooting from auto	1
Shooting from highway	8
Hunting on posted lands	15
Night hunting	9
Abalones—	
Over the limit	24
Undersize	52
Using for bait	10
Black Bass—	
Fry for bait	4
Over the limit	1
Catching with net	9
Fishing without license	4
Fines collected	$3,082.50

RIVER PATROL ACTIVE.

The launch "Quinnat," which is responsible for law enforcement on the Sacramento and San Joaquin rivers and on the Bay, rounded up many violators during December and January last. Twenty illegal nets were confiscated. Each net was about 250 fathoms in length, and worth at least $300. Each was of unlawful size or was being illegally used. Five miles of net is therefore represented in these confiscations. Those nets with small mesh will be burned, whereas those of legal size will be sold. It is only through active law enforcement of this kind that we may expect to safeguard our fishery resources and also play fair with those who are willing to obey the law.

POLLUTION OF COASTAL WATERS.

The subject of pollution of our coastal waters is receiving attention nationally and the first convention was held at Atlantic City last September. The National Coast Anti-Pollution League was the result, with Gifford Pinchot as president, and every Chamber of Commerce on the Atlantic and Gulf Coast was represented. Through this League legislation will be passed curbing pollution by oil burning steamers and large industrial plants adjacent to the seacoast. This form of pollution has destroyed fishing and bathing at most of our New Jersey seacoast resorts and will get to them all if something is not done in the very near future. However, the Hackensack, Passaic and other rivers flowing into the bay were sources of pollution before the advent of oil burning steamers and it is the duty of the organized sportsmen and the Fish and Game Commission to put a curb on this inland pollution.—*New Jersey Outdoorsman*, December 1922, p. 8.

WHAT DO TROUT EAT?

The success of stocking experiments of all kinds is largely dependent upon available food supply. Quail cannot be expected to succeed when planted in localities where food is at a premium. Trout cannot be expected to thrive in streams lacking insect life. Recently, experience has shown that the food supply of trout may be introduced along with the trout themselves. Success in such introduction is dependent upon knowledge of the normal food of trout. The United States Bureau of Fisheries, in cooperation with the United States Forest Service has been investigating the food of trout in Fish Lake, Utah. Actual stomach examinations were depended upon for evidence. The following tables furnished by Mr. S. B. Locke, U. S. Forest Service, gives the result of investigations made last fall:

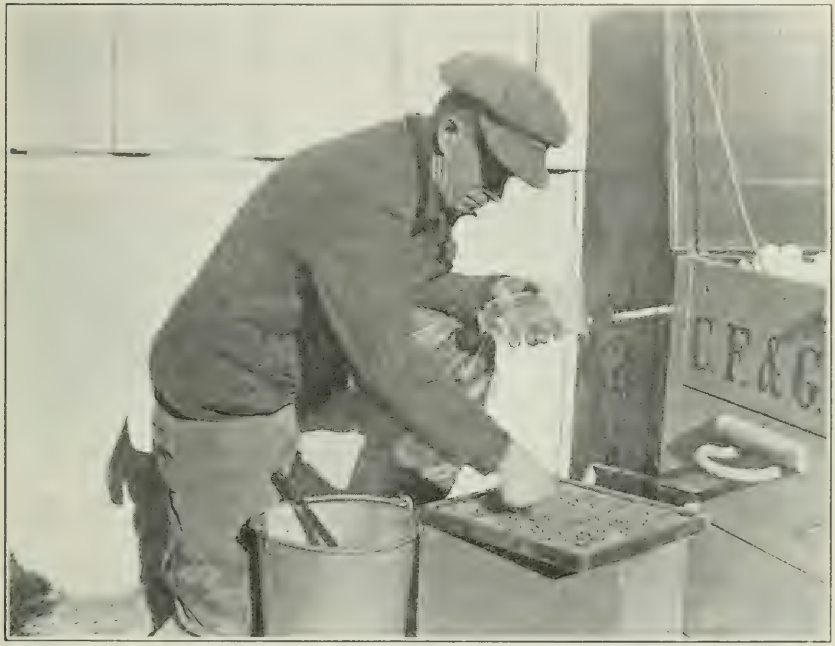

FIG. 21. Packing salmon eggs at the Mt. Shasta Hatchery. By packing in this manner, eggs are successfully shipped half way around the world. Photograph by H. C. Bryant.

CONTENTS OF FISH STOMACHS TAKEN AT FISH LAKE, UTAH,
From August 29 to October 31, 1922, Principally During October.

Species of fish	Number submitted	Empty, per cent of total	Per cent of number containing food in which the following classes occurred							
			Amphipods, G. limnaeus, H. Azteca, scuds or shrimps	Cladocera, Daphnia, water fleas	Fish eggs	Plants†	Gastrapods, snails	Lamellibranchia, shellfish	Fish remains	Insects, etc.
Eastern Brook*	49	37	33	42	40	10	8	0	0	6
Rainbow and Steelhead	11	18	90	0	0	80	10	20	10	10
Mackinaw	2	0	100	0	0	33	0	0	0	0
Not labeled	8	7	80	0	0	16	0	16	0	0
Total	68	27	54	30	28	24	8	6	2	6

†Fragments probably accidentally included with other foods, generally amphipods. *The large number containing fish eggs is due to the fact that collections of this species were made principally after spawning began.

Remarks—From a volume basis amphipods made up at least 90 per cent of the stomach contents. Thread-like parasites were found as follows: Eastern Brook, 0 per cent; Rainbow, 10 per cent; Mackinaw, 0 per cent; not labeled, 33 per cent; total, 6 per cent.

CALIFORNIA WILD LIFE.

I have just been reading the October number of CALIFORNIA FISH AND GAME, and it has stirred my thoughts and desires, as that excellent magazine always does. In particular, my thoughts now run to the necessity for eternal vigilance and alertness in public matters and my desire to aid the increase and practical application of such vigilance.

I notice that Mr. N. B. Scofield makes a very mild and modest (tinged with hopelessness) statement of the approaching exhaustion (or destruction) of our salmon fisheries. For many years warnings have been given of this trend of affairs, yet we as a people have made no effective move to preserve this remarkable resource. The best which we have done has been to postpone the evil day.

To the whole body of California citizens the Fish and Game Commission stands in much the same relationship as do eyes to the individual man. We would not think much of the intelligence of a man whose eyes gave him repeated warning of injury to his flocks, but who persisted in keeping a sheep-killing dog until his flocks were all destroyed. Commercial interests are essential to the proper use of the salmon resource, but, like many other essential agencies, they become dangerous when out of control. If citizens of California have any pride or interest in the salmon fisheries, they must make proper provision through the legislature for salmon protection.

The case of the salmon is only one of many illustrating the necessity for unceasing attention to the conditions of our wild life resources. We, as ordinary citizens, do not know how to direct the necessary vigilance, nor do we know how to interpret the dangers revealed by it. Furthermore, we do not like to be disturbed by matters outside of the ordinary routine of our lives, and we do not like the conflict necessary to maintain our rights. For such reasons it is evident that the desirable and reasonable and practical thing to do is to appoint competent officials (such as the fish and game officials) to exercise vigilance for us and to supply such officials with funds, equipment and authority to protect our natural resources and to fight for our collective rights. In that way our own exercise of vigilance may be safely limited to maintaining the good character of our officials and to sustaining the good quality of their service.

Mr. Scofield mentions in connection with his comment on salmon the fact that commercial interests are responsible for approaching exhaustion. They have not only carried on a mad contest in catching the fish, but they have also supported powerful lobbies in the legislatures to prevent regulation. So long as there is insufficient regulation there is some excuse for the crazy activity in catching. All fishermen understand more or less clearly that a certain percentage of fish must remain uncaught within certain areas in order to produce young. Perhaps honest and intelligent fishermen limit their fishing accordingly until they see that unprincipled competitors are destroying the surplus anyway. With heavy investment in the business the honest man feels that he is then excusable for making a rush to get his share before complete destruction has actually occurred.

This, however, is not true of the lobbying against regulation. As a matter of fact, regulation favors the honest fisherman because it gives him the best possible assurance of permanence in his business. Destructive lobbying is a characteristic of the predatory interests, which can be met only by making as determined and vigorous a fight as they do. While we must depend mainly upon our legislators and other officials to make the direct fight against destructive aggression, we can add a very great deal of encouragement and moral support.

In time of war we were all made to understand that an army can do nothing without proper support at home. Most of us did many different things to furnish both moral and material aid in support of the army, and we did them not only willingly, but enthusiastically. What we call a time of peace is really a time of concentration of attack upon enemies different from those recognized in war time. The right kind of public officials need and deserve enthusiastic public support, just as much as did our soldiers and sailors in war time. The wrong kind would often be kept in the right way by proper encouragement. It seems to me that such relationships are unusually plain in connection with such a question as that of our wild life resources, but they are also apparent in other matters.

At any rate, our only hope of keeping up a supply of certain kinds of wild life is by procuring effective protection and regulation.—W. E. ALLEN (California Biological Feature Service).

UNDER FIRE.

Although political attacks are endless, and although threats are often made and guns used in connection with the law enforcement force, yet it is seldom that such a "Black Hand" letter as the following is received by the Fish and Game Commission. As might be expected of such a letter it is anonymous:

"Fish and Game Commission,
San Francisco:

"We hear something of them raising the licenses to $5.00 for fishing and hunting. We think they are high enough and plenty of graft in them the way they are now. We will get even on all you grafters if you raise them. Here is how we will get even with you fellows. We will shoot game all year round without *any licenses*, and set fire to all the forests. How is that? Better not monkey with them.—S. F. Citizen.

P. S. *Raise it, you dare.*"

ALIENS ARRESTED FOR NETTING SONG BIRDS.

A delicate, silken net, imported from Italy and set to snare song birds, was the means of getting John Matteucci, P. Gomi and E. Bandoni, three residents of San Francisco, caught in the meshes of Fish and Game Commission law enforcement net recently. The men, who declared they were catching the birds for food, had stretched the net across a canyon at Pedro Valley and with sticks were beating the bushes and driving the birds down to be entangled in the delicate fibres, when Deputies Jack Burk, M. S. Clark and L. Sherwood closed in upon them. About a dozen small birds had been snared. The defendants were fined $100 each, by Justice of the Peace Ray Griffin. This should help to discourage other seekers after such delicate, but forbidden, bits of food.

THE FUTURE OF THE ANTELOPE.

Mr. Smith Riley, in charge of the administration of the Federal bird and big game reservations, gave an interesting discussion of the antelope problem before the American Game Protective Association in New York last December. He pointed out the danger of the antelope becoming extinct. Unlike the buffalo, it has been found impossible to breed these animals in captivity; consequently, this means of maintaining the species is not usable. According to Mr. Riley, the only possible solution of the problem is to be found in cooperation between sportsmen and stockmen, and the establishment of federal or state game refuges, under constant supervision, where antelope can be given rigid protection twelve months a year.

Mr. Riley further stated that in some localities in the West, European sheep herders who want the range of the antelope for their flocks, are wantonly slaughtering these animals. They are doing this thinking that they can save the grazing lands for their own uses by killing the antelope and thus removing cause for the Government to set aside large areas of land as refuges. Mr. Riley asserts that there is plenty of room for both the antelope and the sheep, but that unless some action is taken at once it will be too late to save this disappearing species.

MANY QUAIL IMPORTED FROM MEXICO.

From November 1, 1920, to April 20, 1921, 37,953 quail were imported from Mexico. This is the largest number imported in any one season. As heretofore, through the cooperation of the Bureau of Animal Industry, inspection was provided at the several points of entrance, but only shipments showing actual evidence of quail disease were quarantined. With the exception of about 500 birds placed in quarantine at Laredo, Texas, there were few losses due to the disease. The state game authorities of Kentucky, Maryland, and Pennsylvania received most of these quail and distributed them for propagating purposes. Those which went to Maryland, constituting almost one-third of the total number imported, sustained a loss of less than one per cent due to deaths en route.

BOUNTY LAW IN PENNSYLVANIA.

In a recent number of the *Bulletin of The American Game Protective Association*, Mr. Seth E. Gordon, Secretary of the Pennsylvania Board of Game Commissioners, describes "How Pennsylvania Controls Vermin." Historically, the first vermin laws in that state date back to 1683, when a bounty of 10 shillings was offered for the killing of a dog wolf, and 15 shillings for a female wolf. A new angle on the usual reasons cited for the repeal of the bounty on hawks and owls, enacted in 1885, is made when it is pointed out that the hasty repeal was probably due to a strain on the state's funds rather than upon a resultant increase of rodent pests. It is admitted that in the past there was much fraud in connection with the bounty system, but that at present, administration does not admit of dishonesty. During the operation of Pennsylvania's bounty system almost one million dollars has been paid in bounties. Since 1913 the sportsmen have paid out a total of $915,777 for bounties. The total paid in bounties in 1922 amounted to $121,819.50. Skins presented in this year for bounties included 429 wild cats, 5332 gray foxes, 3525 red foxes, 9 minks and 66,726 weasels. The 1915 law provides for a bounty of $6 on wildcats, $2 on foxes and $1 on weasels and minks. Most of the vast sum paid has gone to rural residents, especially the boys on the farms, who spend their winter months in trapping.

Although the article presents an interesting defense of the bounty system as practiced in Pennsylvania, we are in doubt as to whether the increase in game can be attributed in large part to vermin control, in that a large system of game refuges have also recently been established. And furthermore, we wonder whether the amount paid in bounties in 1922 would not have been just as productive in saving game if it had been spent for law enforcement and for game refuges.

HILL AND MOUNTAIN CLUB.

The Tulare County Hill and Mountain Club, which expects to enroll thousands in its mission of protecting the hillsides from thoughtless Sunday motorists and picnickers, has taken this as its pledge of membership:

"I pledge myself to leave our hills and mountains as beautiful as I find them; to observe, and to aid in the enforcement of, all measures intended to preserve their natural features; and to respect private property and the rights of others."

The club is dedicated primarily to protecting wild flowers and shrubs and the property of people in the hills which is invaded every Sunday by thousands of motorists who often, through thoughtlessness or wantonness, do a great deal of damage besides strewing the ground with tin cans, bottles and other unsightly debris. Often camp fires are left unextinguished. Fences are sometimes broken down and gates left open.

The same state of affairs exists in nearly every attractive part of California, judged by complaints that reach the newspapers. Nothing but a great campaign of education will be permanently effective in mitigating this nuisance. Giving every resident of the county a personal interest in seeing that flowers shall not be torn up by the roots or private property roughly treated appears to be the plan of the Tulare club. The whole state of California should have a Hill and Mountain club. San Joaquin county needs one. We are ardent picnickers and the season for taking to the open is at hand. It should be a point of honor for every valley dweller who enjoys the privilege of an outing on another person's land—and most all land is privately owned—to adopt some such code of behavior as is outlined above in the pledge of the Tulare folk.—Stockton *Record*, Mar. 5, 1923.

YUKON SALMON MATURE AT LATER AGE THAN SACRAMENTO SALMON.

Striking differences between the growth and the age at maturity of the Yukon salmon, and those of the southern waters of the Pacific coast are revealed in studies made by Chas. H. Gilbert and Henry O'Malley, for the U. S. Bureau of Fisheries, and reported by Dr. Gilbert in Vol. XXXVIII, No. 928, of the Bureau of Fisheries Bulletin issued in November, 1922.

Although it is not known whether the Yukon salmon spend all of their lives in the Bering Sea, or whether they traverse the passes of the Aleutian Islands and complete their growth in the North Pacific, it is known that in May and June, when the fish seek the mouth of the Yukon, the surface temperature of Bering Sea is near 40° F. With such unfavorable temperature conditions, there can be little or no growth during the winter season, and growth may not start in the spring before the fish begin their streamward migration. In the Yukon salmon, the scale structure indicates no growth beyond that of the winter check of the previous year, so that a salmon in its fifth year would show by its scale structure the completion of but four years' growth, whereas salmon of the spawning run in rivers to the south, where temperature conditions are more propitious, indicate very clearly by their scale structure that rapid growth has already begun before the fish seek the fresh water of the streams.

A striking contrast was also observed between the early history of the Yukon king salmon fry and fingerlings, and those of the Fraser, Columbia, Klamath, Sacramento, and other rivers. In the southern waters, many of the young fish remain in the streams for a comparatively short time, passing then to the sea, where the major portion of their first year's growth is completed. These are designated as the "sea type" and they develop earlier than do those which remain in the river during all of the first year. Often half or more than half of a spring run is made up of these second year fish of "sea type." Dr. Gilbert reports that in their studies of the Yukon salmon, no fingerlings were captured on their downward migration, and the scales of the adult fish clearly record the fact that invariably the young remained a full year in the river. Further proof is offered in the absence of the "sea type" in the Yukon runs.

The third important difference noted is that the Yukon salmon reach maturity at a later age than do those of the southern districts. In the spawning run of the Columbia River, the youngest king, or "chinook," salmon of stream type captured are in their second year, and they constitute a due proportion of the run. The second and third year fish are all males. The youngest stream type females taken are in their fourth year, and then they appear in about equal numbers with males of the same age. In the Yukon run the youngest males taken, with but one exception, were in their fourth year, and the youngest females found were in their fifth year, the females not being found in abundance until in their sixth year. This makes it apparent that maturity is reached one and, frequently, two years later in the Yukon king salmon than in the same species in its more southern range.

COURTS IMPOSE HEAVY FINES FOR ILLEGAL DUCK HUNTING.

As evidence of the increased seriousness with which violations of the Migratory-Bird Treaty Act and Regulations are being regarded by federal courts, it is pointed out by the United States Department of Agriculture that during January, reports reached the Bureau of Biological Survey indicating fines of $100 each assessed in ten cases. In two of these the defendants were required to pay ocurt costs in addition. Nine of the ten fines were imposed in January, the other in December.

Four states were represented by these cases—five of them occurred in Louisiana, two in Illinois, two in Mississippi, and one in Wisconsin. The offenses involved the possession of wild ducks in closed season, sale of wild ducks, and killing wood ducks, woodcock, and wild ducks during the close season. There were altogether 100 cases of violation of the Migratory-Bird Treaty Act terminated in January. In addition to the fines noted, a Maine hunter was fined $50 for killing ducks after sunset, and there were seven cases where the fine was $25 and costs for killing ducks, grebes' sandpipers, or insectivorous birds. Fines ranging from $1 to $25, with costs sometimes exceeding the fine, were imposed for killing nighthawks (or bull-bats), bitterns, turnstones, knots, godwits, gulls, thrushes, gallinules, grebes, flickers, robins, woodpeckers, and doves, and for possessing a night heron.

Recommendation was made for prosecutions in eighty-three cases, involving many kinds of violations of the Migratory-Bird Treaty Act and Regulations, during the month. Hunting from motorboats was a particularly troublesome form of law-breaking in many states.

BURNING OVER WASTE LANDS A MENACE TO WILDFOWL.

The practice in some sections of burning over waste land and marshes during April and May frequently results in great destruction of bird life and birds' nests and eggs, particularly on marsh land where wild ducks breed, according to the Biological Survey of the United States Department of Agriculture. The department suggests that where it is at all possible the growth should be left alone, or the marshes burned previous to the arrival of the birds or the building of the nests, which would be, generally speaking, in February and March. In many instances the burning is unnecessary and no good purpose is served by it. Due to the draining of numerous areas throughout the country for agricultural purposes, suitable breeding places for birds are constantly becoming fewer in number, and for this reason the unnecessary burning over of waste lands and marshes should be discouraged everywhere by bird lovers, conservationists, and sportsmen.

FACTS OF CURRENT INTEREST.

State mountain lion hunter, Jay Bruce, has been successful in bagging five mountain lions in the Mt. Hamilton range, east of San Jose, during the past few months "Big Jim," a lion made famous by his depredations on cattle, was among the lions captured. He proved to be of large size.

* * *

Monterey County sportsmen have organized into six strong fish and game protective associations.

* * *

In February, the Stafford Packing Company of Wilmington, California, had its license revoked for violation of the fish reduction law. It was shown that this company had used an excessive amount of usable food fish in its reduction plant.

* * *

Friends in need are friends indeed! Many fish and game protective associations and chambers of commerce passed resolutions endorsing the demand of the Fish and Game Commission that all license fees be retained in a separate fund for use in fish and game conservation.

* * *

Sportsmen of Monterey County have complained bitterly of the pike, which is said to have ruined angling in many of the streams of that county. Investigations are being made to determine the best means of controlling this fish.

* * *

Several bills calling for additional game refuges were introduced at the recent session of the legislature, notably one establishing a refuge in the coastal area of Humboldt County.

* * *

Large numbers of whistling swans fed in the rice fields of Butte County last winter. Most of them had left for the north by March 4th.

NOTES FROM THE STATE FISHERIES LABORATORY.

WILL F. THOMPSON, Editor.

THE DEPLETION OF THE NORTHERN HALIBUT.

The signing of an international treaty for the protection and study of a threatened species of fish is an important event to fisheries men. The significance of the agreement should be appreciated and its probable consequences realized. This treaty, between the United States and Canada (represented by Great Britain), for the preservation of the halibut, provides for a close season during three winter months, this to hold for a period of five years. It further creates a commission of four men, two to be appointed by each country, for the study of the life history of the halibut.

This is one of the first, if not the very first, treaties restricting marine fishing operations because of recognized and acknowledged overfishing. The possibility of exhausting one of the so called "inexhaustible" species of marine fish would seem to be proved, at least to the extent of commercial failure of the fishery. It will naturally be contended that the other species are not as susceptible, but such a plea will lose much of its force in the face of the demonstrated fact. The interest in our marine fisheries should, therefore, be intensified. The success of the close season, and of the commission for investigation in its scientific study, should be of considerable significance in the future treatment of threatened species.

There will be, also, on trial the possibility of competent international action in such cases.

FIG. 22. Folsom fish ladder on American River. Photograph by A. E. Culver.

THE PURSE SEINE INVESTIGATION.

Dr. Skogsberg has completed his investigation of the purse seine fisheries and his report is now ready for publication. It reviews the extent, methods, history and effect upon the supply, of the purse seine fisheries. It should prove of interest and value.

THE MOVING OF THE LABORATORY.

The city of Los Angeles contemplates the moving of all the leases and streets at East San Pedro which conflict with the plans for the new Union Pacific terminals. The Laboratory will be moved two hundred fifty feet toward the southeast, and the extent of the ground allotted to it will be reduced very considerably. Its location relative to the streets will remain the same as now. Future development in the vicinity promises to make the Laboratory grounds very valuable.

THE HAWAIIAN "SKIPJACK" IN OUR WATERS.

During the fall of 1922, when tuna were being taken in Lower California off Turtle Bay and preserved in San Diego and San Pedro canneries, there appeared very considerable numbers of *Euthynnus alleterata*, or a very closely allied species. The specimens examined, taken here as skipjack, corresponded in all respects to the descriptions of fish taken in Hawaii, and may be regarded as the same as the species found there—perhaps even the same as the Atlantic form.

The body differed notably from that of *Euthynnus pelamis*, the common "skipjack" here. Instead of tapering abruptly to the tail from the beginning of the dorsal and anal fins, as that species does, the posterior part of the body was drawn out, somewhat compressed from side to side, and the caudal peduncle was relatively long and slender. This difference between the two species of *Euthynnus* is entirely similar to that between the albacore with its thick body posteriorly, and the yellow-finned and leaping tunas with their drawn out, more slender forms. *E. alleterata* is heavy toward the head, but *E. pelamis* is nearly symmetrical. Other differences were the presence of several spots below the pectorals, a dark meat, and the absence of a marked bend in the lateral line anteriorly.

The species may be of considerable commercial importance if the meat does not prove too dark.

Attention was first called to the species by Mr. Norman Hendrickson, of the Van Camp Sea Food Corporation, into whose canneries at San Pedro some of these fish were brought.

THE USE OF FISH AS FERTILIZER.

It is taken for granted that fish should be used for fertilizer only when all demands for it as a food product are satisfied. Its use for fertilizer or fish meal assumes that there is a surplus, and that the additional strain is not a drain upon the capital, but consumes only the interest. If the extent of the supply were accurately known, it would not seem that there could be any legitimate objection to the use of whatever surplus was left.

But, as has been said before in these columns, there is no way of knowing what strain a species will stand until it is tried. There is no method of comparison by which the productivity of our waters can be compared with that of other seas, nor is there yet any basis upon which any one species may be judged more productive than another. Our waters differ widely in character from the waters of the older and better known fishing areas in the Atlantic, and our species resemble very little those existent there. The narrow continental shelf of somewhat arid California contrasts strongly with the large shallow extent of the North Sea and the great rivers which flow into it, bringing down to the sea, food elements for the enormously abundant cods, flounders, and herrings that correspond to our mackerels and sardines.

There is no way, then, to estimate the future limit of our fisheries. All we know is that they are exhaustible. The possibility and actuality of overfishing warrants the expectation that it may appear in any species, even the sardine and herring in course of time. That being true, it should follow that no fishery should be allowed to "run wild."

Yet, it is certainly a great waste to allow fish supplies which could be used to go without use. And, very obviously, if there are methods of doing this safely, it should be done. If it is possible to observe overfishing when it does occur before irreparable damage is done—as should be possible by scientific research, then once the means and methods are provided for, and put into use, exploitation should be unhampered. Research and statistics are, then, necessary to justify free development of our fisheries.

Some of our surplus may justifiably be used for fishmeal and fertilizer, but the common sense of the people of California and the canners themselves should insist that such use be carefully guarded and never get beyond control. Control over a great industry making fertilizer would be very difficult, and it would seem that caution should be exercised in allowing such to develop.

MEXICAN FISH IN CALIFORNIAN MARKETS.

Coincident with the development of California and inland markets has been the continued extension of active fishing operations farther down the coast of Mexico. This increased activity has brought to the fresh fish markets of San Pedro several species of fish common in Mexico, but new and strange to the American public. Lacking adequate names, the dealers have given them the names of familiar domestic fishes such as "striped bass," "perch," and "barracuda." A number have been sent to this laboratory for identification, through the kindness of Captain Bernsen of the purse sein boat "Mable," and Mr. Oliver of the West Coast Fish Company. These included the following:

From Turtle Bay, Lower California, December, 1922.

Epinephalus analogus, Rock hind or "Cabrilla pinta," a bass of good quality.

Sphyraena ensis, a Mexican barracuda, or "Vicuda" differing somewhat in appearance from our local species.

From Magdalena Bay, Lower California, December, 1922.

Centropomus pedimacula, a bass-like fish, hence Mexican bass—of apparent market value, but not a *striped bass*, despite its markings.

A number of fish of little or no food value were also brought in as curiosities, from Magdalena Bay, December, 1922, including:

Diodon holocanthus, porcupine fish.

Fistularia depressa, Cornetta or trumpet fish.

Balistes polylepis, Trigger fish, and

Selene vomer, Horse-head.

The introduction of new food fishes into our markets is highly desirable, since a diversity of supply may reduce the strain on our already overtaxed popular species.

CONSERVATION IN OTHER STATES.

NEVADA WAKES UP.

A number of fish and game protective associations have been formed in Nevada and a unification has been carried out under the Nevada State Fish and Game Protective League. The official bulletin of this league shows that sportsmen of Nevada are awake to the need for better conservation, and since the slogan is "Nevada—the Home of the Antelope," it is to be hoped that this disappearing game mammal will be given needed protection in that state.

In an article appearing in the February issue of the bulletin, published by the League, the president, Mr. T. A. Read, appeals to all sportsmen, whether personally interested in the recreation afforded by wild life or not, to get behind the movement and by cooperating with organizations whose aim it is to propagate and protect the fast disappearing fish and game of the state, to preserve these invaluable resources for the enjoyment of coming generations.

In this connection it is interesting to note that two boys' clubs have been formed for aiding in this work, and the organization of others is planned. In the Junior Sportsmen's Club of Washoe County the members are sworn to "intelligence service" with the Washoe County Game Warden, and in the Reno High School a cooperative fish and game club, recently organized, declares its purpose is "to aid in bringing game law violators to justice."

NEW JERSEY ORGANIZES CONSERVATION LEAGUE.

The New Jersey Fish and Game Conservation League, organized in 1918, has been actively engaged in advancing the interests of the sportsmen in that state. In December this organization issued an attractive publication, the *New Jersey Outdoorsman*. The aims of the organization, expressed in this publication, are: The obtaining of favorable legislation; the destruction of the bird-killing cat: the reporting of violations; and the admonition of the thoughtless hunter who brags of getting the limit all the time, who kills every bird in the flock, and who is careless regarding fires, his gun and other people's property. The league also proposes to change the present drastic trespass law which is far from acceptable to the bulk of hunters and anglers. It is claimed that the present law, which affects sportsmen, was handled entirely by the Agricultural instead of the Fish and Game Committee of the legislature.

MONTANA INTRODUCES HUNGARIAN PARTRIDGES.

In the spring of 1922 Montana imported 1080 Hungarian partridges for distribution in that state. Enthusiasm over these birds was first aroused among the sportsmen of Montana by the migration of partridges into the northern part of the state from the province of Alberta, Canada. Fourteen years ago, one hundred ninety-five pairs of Hungarian partridges were planted near Calgary and now Alberta has more of these birds than of their own native prairie chicken.

Sportsmen and game authorities of Montana are gratified with the way in which the foreign species is adapting itself to climatic and other conditions. Partridges are reported as nesting and thriving in all of the sections where liberated.

UNITED STATES FOREST SERVICE COOPERATION.

PAUL G. REDINGTON, Editor.

FOREST OFFICERS ARREST MANY GAME VIOLATORS.

Thirty-eight arrests in the National Forests for violations of the state game laws were made by officers of the United States Forest Service during 1922, and convictions secured in every case. In addition, these officers reported twenty-seven infractions of the game laws to the State Fish and Game Commission, all of which were successfully prosecuted. This action is in keeping with the avowed policy of the Forest Service, in cooperation with the State Fish and Game Commission, to stamp out game violations.

DEER POACHERS FINED.

A. P. Geerdst and D. A. Barack of Harmon Court, Oakland, Cal., were recently arrested by officers of the United States Forest Service and fined $25 each by Judge de Ferrari of Groveland for shooting at and wounding deer out of season near South Fork on the Stanislaus Forest. The men were charged with shooting fawn four times with two different caliber guns.

SUMMER HOMES IN NATIONAL FORESTS POPULAR.

If you want a summer home in the California mountains, at a nominal cost, it's high time you were getting busy, for the United States Forest Service reports that the choice lots in the National Forests are going like hot cakes. At the close of 1922 there were 3401 recreation permits in effect on the National Forests of the state, a gain of more than 15 per cent over the previous year. Of this total, 3073 permits were for summer home sites, and 288 for hotels, resorts, municipal camps and other recreation features. The leading summer-home forests are the Angeles and Cleveland in Southern California and the Eldorado, Sierra, Stanislaus and Sequoia in the Sierra region. The 3400 recreation permits in the National Forests of California return an annual revenue of more than $50,000 to the government, and the improvements made by permittees represent an investment of over $3,000,000.

RANGERS WAR ON FOREST OUTLAWS.

Forest Rangers last year killed 274 mountain lions, coyotes and bobcats on the National Forests of California, reports the United States Forest Service. The destruction of these forest outlaws will save many deer and other game, as well as thousands of dollars worth of live stock, all of which are preyed upon by these varmints. The Santa Barbara National Forest in Southern California heads the list with a kill of 105 coyotes, 53 wildcats and 41 mountain lions. The destruction of predatory animals is one of the many cooperative activities of the rangers in the interests of the users of the National Forests.

INDIANS FINED FOR KILLING DEER.

John Jordan Jr. and Sylvester Simmons, two Indians of the Paskenta region, were recently arrested by officers of the California National Forest for killing a doe each in the Lake Hollow region. Both defendants pleaded guilty in the court of Judge Lee at Paskenta and were fined $50 each. The deer meat seized was turned over by the Forest Rangers to the County Hospital at Red Bluff.

SEIZURES.

From July 1, 1922, to December 31, 1922.

Game.

Ducks	2,380
Quail	64
Nongame birds	7
Shore birds	28
Geese	51
Pigeons	9
Sage hens	27
Doves	79
Rabbits	24
Spike bucks	4
Does	2
Deer meat	435 lbs.
Deer hides	3

Fish.

Abalones	181
Barracuda	1,475
Clams	1,086
Crabs	2,133
Crabs	18½ lbs.
Lobsters	157
Lobsters	1,582 lbs.
Halibut	1,050 lbs.
Salmon	1,985 lbs.
Trout	151
Trout	550 lbs.
Sturgeon	254 lbs.
Striped bass	1,524 lbs.
Black bass	33
Crawfish	100 lbs.
Crawfish	50
Mussels	260

VIOLATIONS OF FISH AND GAME LAWS.

July 1, 1922, to December 31, 1922.

Offense	Number of arrests	Fines imposed
Game.		
Hunting without a license	49	$750 00
Hunting on posted grounds	13	150 00
Birds, nongame, possession, killing	27	740 00
Birds (shore), killdeer, possession	17	395 00
Deer, possession, killing, closed season	1	25 00
Spiked buck, killing	15	843 00
Does, possession, killing, closed season	16	1,225 00
Fawn, possession	12	625 00
Deer meat, possession, closed season	29	885 00
Doves, killing, closed season	17	400 00
Ducks (wild), killing, shipping, over limit, closed season	30	1,295 00
Rabbits, killing	12	250 00
Quail, possession, killing, out of season	28	900 00
Hides, illegal possession	1	50 00
Failure to retain head or horns of deer	12	425 00
Shooting from automobile or power boat	5	110 00
Night hunting	16	565 00
Trapping without a license	2	40 00
Total game violations	302	$9,583 00
Fish.		
Angling without a license	22	415 00
Fishing (market) without a license	36	500 00
Dynamiting fish	1	200 00
Illegal fishing apparatus, nets, etc.	1	100 00
Abalones, undersized, overlimit	15	375 00
Barracuda, undersized, possession, selling, illegal	2	75 00
Bass, undersized, possession, overlimit, closed season	23	500 00
Clams, undersized, possession, over limit	42	1,225 00
Crabs, undersized, possession, shipping	3	20 00
Crawfish, under or over size, closed season	3	45 00
Lobsters, buying and selling undersized	16	375 00
Salmon, taking and possession, closed season, etc.	4	300 00
Halibut, underweight, possession and sale	3	60 00
Sturgeon, taking or possession	2	50 00
Trout, closed season, over limit	8	200 00
Fishing with grab hooks	1	100 00
Using seine net in closed districts	3	200 00
Using a set net	1	147 00
Using nets in District No. 1	5	1,296 00
Taking fish within 150 feet of fishway	2	25 00
Fishing in District No. 14	1	20 00
Snagging fish in inlets	5	125 00
Taking fish, other than with hook and line	8	195 00
Using a line in closed waters	1	125 00
Failure to make out a receipt for fish received	1	100 00
Night fishing	3	25 00
Obstruction in stream	1	25 00
Using net in District No. 12	6	500 00
Total fish violations	219	$7,323 00
Grand total	521	$16,906 00

FISH AND GAME COMMISSION.

Statement of Income for the Period July 1, 1922, to September 30, 1922.

LICENSE SALES:	
Angling	$ 60,647.00
Hunting	70,349.00
Market Fishing	22,130.00
Wholesale Fish Packers	875.00
Trapping	89.00
Game Breeders	10.00
Fish Breeders	5.00
Kelp	10.00
Total License Sales	$154,115.00
Court Fines	$ 8,235.50
Fish Tag Sales	1,508.17
Fish Packers' Tax	1,278.43
Total Income	$165,137.10

STATEMENT OF EXPENDITURES

For the Period July 1, 1922, to September 30, 1922, of the Seventy-fourth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			$55 85		$55 85
Executive offices	$61 63	$3,992 97	1,535 28	$100 40	5,690 28
Printing			820 67		820 67
Research and publicity	11 51	1,150 00	254 98		1,416 49
Accident and death claims			504 18		504 18
Department totals	$73 14	$5,142 97	$3,179 96	$100 40	$8,496 47
Commercial fish culture and conservation:					
Superintendence	$21 01	$2,385 00	$1,100 75	$8 15	$3,514 91
Inspection and patrol	1,419 43	5,196 45	1,651 96	47 59	8,315 43
Research	41 14	4,801 98	1,040 70	52 81	5,936 63
Statistics		1,293 87	28 26		1,322 13
Market fishing license commissions			131 50		131 50
Propagation and distribution of salmon	2,250 31	4,204 90	262 55	65 77	6,783 53
Department totals	3,731 89	17,882 20	4,215 72	174 32	$26,004 13
Sporting fish culture and conservation:					
Superintendence	$135 50	$2,985 81	$7,529 13	$6 25	$10,656 69
General patrol (40 per cent)	81 73	11,925 93	8,585 30	15 68	20,608 64
Trout propagation and distribution	10,482 25	19,330 67	10,297 56	154 72	40,265 20
Department totals	$10,699 48	$34,242 41	$26,411 99	$176 65	$71,530 53
Game conservation:					
Superintendence		$300 00	$7,229 18		$7,529 18
General patrol (60 per cent)	$122 57	17,888 88	12,878 18	$23 52	30,913 15
Department totals	$122 57	$18,188 88	$20,107 36	$23 52	$38,442 33
Tahoe camping grounds	$8 60	$461 25	$2 25		$475 10
Grand totals	$14,635 68	$75,920 71	$53,917 28	$474 89	$144,948 56

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF OCTOBER, NOVEMBER AND DECEMBER, 1922.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Colusa, Tehama, Glenn, Butte	Sacramento, San Joaquin	Contra Costa, Alameda	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican brought into California
Albacore										195		676,099	167	126	676,587	
Anchovies								17,636		61,083		150			78,869	
Barracuda									495	10,616	36,455	69,973		89,680	807,219	525,374
Bluefish									2,445	13,038					15,483	
Boccaccio								7,772	31,666	168,913	270				208,621	
Bonito										2,106	2,523	57,336		8,521	70,486	19,251
Carp				934		6,567	2,056	26							9,583	
Catfish		44,929				179	201								45,309	
Chilipepper								1,610	11,378	50,220					63,208	
Cultus Cod	124							101,106	7,247	32,826				939	142,242	
Dolphin																
Eels																
Flounders	690						379	110,142	72	18	525	906		80	113,052	20
Grayfish								27,931						19,457	47,388	
Greenfish																
Hake	117							26,360							26,477	
Halibut								11,934	77	473	89,513	146,613	273	12,336	261,249	35,293
Hardhead						8,654									8,654	
Herring	285		12,180					44,741	1,000						58,206	
Kingfish									740	130	43	89,946		10,754	101,613	
Mackerel									2,335	198,513	1,239	414,210	18,185	13,855	648,337	648
Marlin																
Mullet														15,763	15,763	5,555
Perch	4,846		6,010				33	12,410	8	4,228		26,941	737	1,719	56,932	5,997
Pike				3		694	2,545	32							3,274	
Pompano								57		16		3,286		113	3,472	372
Rock Bass												16,235	251	3,497	19,983	1,369
Rockfish								137,177	65,322	101,473	17,147	219,027	7,128	207,379	754,653	1,772
Sablefish								42,524	26						42,550	
Salmon	168,621		402	34,987		16,636	32,597	1,758	10						255,011	
Sand Dabs								258,088				2,724	49		260,861	
Sardines			125					56,375	190	23,599,753		7,781,595		1,062,678	32,500,716	
Sculpin												13,183	20	1,533	14,736	
Sea Bass—Black												13,491		8,854	22,345	5,599
Sea Bass—White			4,163					9,173	2,010	20	6,993	59,528	1,329	23,159	106,315	269,111
Sea Trout														5,112	5,112	13,918
Shad				122		150	6,995	327							7,594	
Shad—Buck																
Shad—Roe																

Sheepshead											170	142		10,699	11,011	22
Skates								31,454		288					31,742	
Skipjack									13			1,716,748		181,062	1,897,823	1,746,446
Smelt	6,032		4,231					8,401	5,488	12,860	6,370	113,347	121,040	14,099	291,868	3,489
Sole								1,818,462	514	618	8,916	16,649	38		1,846,197	225
Splittail						819									819	
Striped Bass			622	10,415		15,832	129,749	2,368							158,986	
Stingaree																
Suckers						248									248	
Surf Fish																
Swordfish												786		350	1,136	
Tomcod								352							352	
Trout—Farm																
Trout—Steelhead	145														145	
Tuna												27,044			27,044	18,471
Tuna—Bluefin												125			125	8,310
Tuna—Yellowfin												272,883		1,843	274,726	5,085,729
Turbot			2					125							127	
Whitebait								6,954							6,954	
Whitefish												2,298		1,950	4,248	
Yellowtail											6,072	441,717		772,630	1,220,419	10,081
Miscellaneous				277			615	71,292	2,298	2,091	1,271	19,719	128	958	98,649	2,167
Total Fish	180,773	44,929	28,035	46,738		49,779	175.170	2,806,617	133,334	24,259,508	177,447	12,803,701	149,348	2,469,143	43,324,522	7,759,249
Crustaceans:																
Crabs (doz.)	929	421	515				36	8,236	3						10,140	
Ecrevisse (doz.)																
Shrimps			82,413				10,369	93,863							186,645	
Spiny Lobsters											43,916	114,271	15,411	85,303	258,901	173,686
Mollusks:																
Abalones										209,532	4,239				213,771	
Clams—Cockle	4,142		3,375									162			7,680	
Clams—Mixed	3,705	152	360												4,217	
Clams—Pismo									576		43,218				43,794	225
Clams—Softshell			19,760				42,194	13,225							75,179	
Cuttlefish								1,184	3,520	11,980		25			16,709	
Limpets																
Mussels								2,272			101		800		3,173	
Oysters—Eastern (No.)			1,113 453												1,113,453	
Oysters—Native																
Snails																
Squid									39,950						39,950	
Miscellaneous:																
Frogs (doz.)																
Terrapins (doz.)																
Turtles																7,021

All amounts shown in pounds unless otherwise specified.

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"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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GAME REFUGES AND GAME MANAGEMENT ON THE NATIONAL FORESTS.*

By S. B. Locke.

The proper conservation of the game resources of the national forests under the present system of laws must depend largely on the establishment of a series of well chosen game refuges.

In a few cases Congress has established federal game preserves. A provision that such game preserves could be established by a presidential proclamation, when approved by the state involved, has been proposed and would be advantageous since some states have neglected to provide state game preserves.

State game preserves as established are not as stable as desirable, being in some instances frequently changed in size or location and occasionally based on other than sound reasons of game protection, sometimes including areas from which the stockmen have desired to exclude hunters to prevent disturbance of stock rather than to protect game.

Most of the western states have cooperated with the Forest Service in this matter and established such game preserves as have been recommended. Wherever state action is available it is possible to form immediately an effective system of such areas on the national forests.

Each game or bird refuge should be selected with certain definite objects. These will include one or more of the following:

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*Adapted from Manual of Instruction issued to forest officers of the Intermountain district.

To prevent any species from reduction in numbers to such a point as will cause it to lose its value as a public resource.

To provide a place where all game can increase to a point where it overflows to adjoining areas, thus providing normal breeding stock thereon and increasing their value as hunting and recreation grounds.

To increase the game around summer recreation grounds and resorts, where this will increase their attractiveness and value to the public.

To provide a place for liberating and locating shipments of species which have been locally extinct, or are being newly introduced.

The selection of a given area as a game preserve depends largely on a consideration of the following factors:

1. Adaptability to specific species of game, preferably for the year-long season. The inclusion of year-long range is desirable but not essential. The protection of areas where game may concentrate before the hunting season closes, particularly in years of early snowfall, may make an effective game preserve where the range is occupied for only a portion of the year. Sometimes game may be so disturbed by hunters that it may drift out of large areas of suitable range and a game refuge will prevent this as well as provide protection from overshooting.

2. Necessity for preventing the extinction of rare species.

3. Absence of conflicting interests such as grazing, expanding settlements, etc. Exclusion of stock, especially cattle, is not a necessary condition for a successful game refuge in all cases. In most instances a normal stocking of cattle will not interfere with game. Sheep and goats may have to be excluded. It often takes several years for a game preserve to become stocked; there is usually an excess of summer range and areas unessential for game may be included in order to provide a practical boundary for protection so that the necessity of the exclusion of stock of any class will depend upon conditions in each individual case. The development of modern range management plans reduces greatly the possibility of conflict between stock and game. The presence of a limited amount of settlement will ordinarily not prevent a successful refuge unless there is unused agricultural land liable to result in demand for expansion of grazing privileges. In choosing game preserves it is desirable to avoid conflict with other interests wherever possible, but often certain adjustments in other uses are necessary if the game resources are to be conserved.

4. Geographic location with respect to the value of the refuge to surrounding areas as a source of overflow. A refuge so situated as to be valueless as a source of overflow is generally fulfilling only a part of its purpose. Factors preventing an overflow may result in conditions where actual overgrazing and overcrowding by game animals may exist even where there is no conflict with stock grazing. A necessary corollary to this proposition is that each refuge must be considered in position, size, purpose and administration with the system as a whole.

5. Desirability of increasing game around summer recreation grounds and resorts. There is an increasing appreciation and study of game animals by recreation seekers in such localities. The opportunity for such people to observe game animals increases their interest in and support of game protection besides being of educational value and furnishing additional recreational attraction to the forests.

Areas for bird refuges will be selected principally on the basis of the first, second and third considerations. Obviously the greater mobility of most birds renders the fourth consideration less important than in the case of nonmigratory game animals. Protection of birds on range occupied during the hunting season is more essential than the inclusion of range used year-long.

Except where descriptions follow posted boundaries of the national forests, it is preferable to describe proposed game refuges by definite topographic features which are much more easily recognized and posted than boundaries based on legal subdivisions or land office survey lines. In the absence of definite topographic features, such as ridges, streams or rock rims, roads may be used.

Whether or not game preserves are established, there are certain factors which will enter into any plan of game management.

The enforcement of the laws is a clear necessity and violation must be prevented. The entire plan of management will rely on this factor since it is dependent on protective laws. The problem is very much simplified by the selection of suitable laws and the utilization of public opinion.

A favorable public sentiment should by all means be fostered. In law enforcement, the support of at least a part of the local residents may make the difference between success or failure to accomplish the object. The backing of a local organization gives particular strength to protective laws. Where local laws are desirable, action taken to establish them should at least seem to originate locally. Even one sportsman in a locality, when convinced of the desirability of certain measures, may obtain support of signers on a petition by local people and in that case the possibility of the measure being effective is many times greater than if the law were sponsored by other than local people. Oftentimes the people in the cities are those who back fish and game protective measures; they generally constitute a large part of the hunters and fishermen, but the measures they propose will be most effective when there are local people or associations with whom they can keep in close touch and sympathy.

There has been a general tendency among hunters to not go far enough to accomplish results in game protection, the selfish feeling of not wanting to give up hunting for even short periods entirely influencing their judgment. It is true that the most progressive measures for wild life conservation have had their strongest backing by nonhunters such as wild life enthusiasts or women's clubs, and that the greatest opposition to game conservation measures comes from hunters themselves. In obtaining the interest of the public, the influence of nonhunters in wild life protection should not be overlooked.

An efficient policy of game protection and development should provide for the organization of sportsmen wherever possible. Such organizations are of inestimable value in influencing legislation and public sentiment and in assisting to make plans effective.

The personal example and the expression of opinion favorable to wild life conservation has considerable influence. The public should be educated to appreciate the value of fish and game or other wild life. This is shown by a statement of its value as a source of meat supply or recreation for local people and the value in attracting and holding hunters from outside sections. The money spent by the latter class is an excellent index of the commercial value of this resource to the local community.

Conflict may arise between wild life interests and other activities, particularly the grazing use. The principle to govern action in such cases will be that of the highest use in each case, but the growing importance of wild life protection should not be underestimated. The adequate protection of wild life seldom requires serious curtailment of the grazing use but certain adjustments in the latter may be necessary to avoid creating conditions unfavorable to the maintenance of a game supply. Proper protection of the forests may require the establishment of open seasons such that fishermen and hunters will not be present during fire hazard periods.

A study of the forage requirements of game will govern the management of areas important for game production. It may be necessary to protect both summer and winter ranges or even to develop sources of winter feed. In the Jackson Hole country, it is necessary to provide hay for winter feeding of elk. There are certain sections in the Adirondacks where the wild hay is cut and stacked to be accessible to deer, when the snow is deep. The planting of wild rice or wild celery is very effective in providing attractive feeding grounds for ducks. The demand for seed of wild celery and wild rice for this purpose is so large that a business is made of supplying it. There is in most localities an abundance of summer range, but settlement or overgrazing of winter ranges has been the primary cause of the decrease of game. Particular attention should be given to this matter in the preparation of plans.

Hunting seasons should be established which will not interfere with the breeding, which will prevent waste of meat, which will not come at such a time as will place game at a disadvantage through driving them into poor winter feed country, and *which will allow restocking to continue*. The greatest amount of sport should be provided that is consistent with the preceding principles.

The importance of the destruction of predatory animals as a game protective measure can not be over-emphasized. In fact, this matter may mean the success or failure of game management, particularly where the numbers of game animals have been much reduced. Close observations of game conditions where predatory animals are numerous have indicated that great numbers of game animals are killed in the winter or spring when the snow is deep or crusted and where the young are just born. A mountain lion will kill one deer a day while feeding its young. The Biological Survey is accomplishing very much in destroying predatory animals and in many cases the states have been cooperating. Sportsmen and game protective associations should support actively every measure which will tend to reduce the number of predatory animals.

A recognition of the fish and game as a resource of the national forests carries with it the duty to administer it on the basis of a permanent production in as great a quantity as is consistent with the practice of forestry and the proper development of other forest resources. Through our cooperation with the states and our control over the use of the national forests, an opportunity exists for the development of practical game management which is impossible elsewhere.

REVIEW OF DR. SKOGSBERG'S REPORT ON THE PURSE SEINE FISHERIES OF CALIFORNIA.*

By W. F. THOMPSON and ELMER HIGGINS.

During the last legislative session the regulation of the purse seine fishery was a very live issue. The Commercial Fisheries Department had foreseen such a situation and during the preceding fall had assigned Dr. Tage Skogsberg of the State Fisheries Laboratory to make a thorough investigation of the purse seiners. Although completed in time for use by the legislature, the report has not been published and it has been thought best to give this advance review, the more so as there is a possibility of extending and completing the report during the coming year.

Dr. Skogsberg handled very completely a detailed analysis of the relation of the purse seine boats to the other fisheries for a period of six months of 1922. He was unable, for the lack of time, to carry this analysis through the entire year. He had at his disposal, however, a very considerable amount of data regarding the commercial catch during the last several years since the Commission has gathered data of the fisheries, and although this material did not separate the catches made by the purse seine boats from those made by other means, it assisted him in his conclusions very greatly. The presence of records of the catches of the individual boats will enable a complete analysis to be made at any time in the future, to supplement what is known from his report.

To the public unacquainted with our fisheries, some general information not provided in the report is essential to its understanding. Of the states, California leads the nation in tonnage of fishery products, yielding, during the three-year period 1919–1921, an average annual amount of nearly ninety-seven thousand tons of fish alone. California's fisheries are most concentrated near the great centers of population, San Francisco Bay region and Los Angeles County, but the southern part of the state, with one-third of the whole coast line produces one-half (50.9%) of the state's entire yield. Therefore, problems affecting southern California's fisheries have a greater proportionate importance than their aparently local nature at first indicates, and the threat of overfishing or the suspicion of wastefulness or inefficiency of methods warrants careful consideration and widespread popular interest. Dr. Skogsberg's report is, from this standpoint, of particular value.

As he says: "In the last few years the supposed destructive influence of the purse seine boats on the supply of fish in our waters has been much discussed among professional fishermen, as well as among other persons interested in southern California sea fisheries and their future, and articles to the effect that aliens were destroying the California natural fish supply by means of purse seines have repeatedly been published in the newspapers. ('For many of them,' the purse seiners, 'nothing is more pleasing than to enrich themselves at our expense and risk.') One of the main objections against these men is that they, by killing small fish in enormous quantities, are depleting the barracuda. There is a fairly widespread opinion that purse seining for barracuda, white sea bass and yellowtail should be prohibited in southern California. A critical reader and listener could, however, not help being impressed by the looseness of the statements and by the fact that the complaints mainly are based on hearsay and only to a very little extent on personal and more or less systematic observations."

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*California State Fisheries Laboratory, Contribution No. 40.

The need for care in coming to any conclusion as to the effect of purse seining is plain when their importance to the markets is considered. It is only common sense to be careful in rejecting a source of supply for the feeding of our fast increasing populations, and the need for steadiness of judgment is especially present when the plea is made that the conservation of that source is involved. (See Fig. 23.)

And Dr. Skogsberg clearly shows that "it is clear that the fresh fish markets to a very large extent depend on the purse seiners for their supply. Of the species of major importance to the fresh fish trade only the halibut and the rockfish are not taken by purse seines. Of the remaining ones the mackerel is mainly caught by the small boats, the barracuda, white sea bass and yellowtail principally by purse seine boats. During the winter months the barracuda and white sea bass are almost exclusively landed by purse seine boats. Taking into consideration that the mackerel is a fish with relatively low market value and that the barracuda and white sea bass are high priced fish much appreciated by the fish-eating public, we are fully justified in saying that, without a more or less steady supply of the three last mentioned fish throughout the year, the fresh fish markets would not be able to furnish the public in southern California with a sufficient supply of desirable fish."

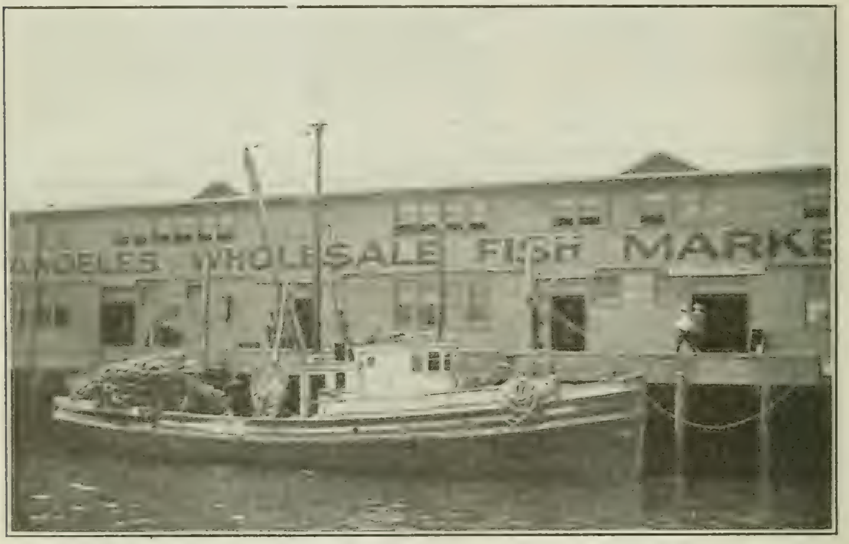

FIG. 23. A purse seine boat at Municipal Wholesale Fish Market, Los Angeles Harbor. Photograph by W. F. Thompson.

Not only is it true of the present, but it will be increasingly true in the future, that the purse seiners must be depended upon for a large part of the supply. "A process which has occurred in other older fisheries has begun here, namely, the outgrowth of the domestic supply by the demand, so that fishing grounds farther away are being used. It will be interesting to see how far the process, which in Europe carries fisherman to the Barents Sea and to tropical Africa, can and will go.'' (Thompson, The Fisheries of California and Their Care, CALIFORNIA FISH AND GAME, Vol. 8, No. 3, p. 167.) ''It is evident by now to almost everybody well conversant with the problems connected with our fishery industry that our local supply of fish for the fresh fish markets is very limited.'' (Dr. Skogsberg mss.) But, ''the exploitation of distant fishing grounds implies the existence of a fleet of large sea-going fishing vessels, economical in operation and fit to carry big loads of fish (on ice, or otherwise preserved), long distances. What will be needed are vessels, large, speedy and economical enough to be able to operate with profit as far away as the Gulf of California and along the coast of Central America. We have, at the present time, in southern California, no vessels approaching this type more nearly than the purse seine boats; they are the only ones which, on a large scale, undertake fishing expeditions to distant waters (along the whole west coast of Lower California). The purse seine fleet provides the only hope for the future development of our fishing industry according to the principles outlined above. A great number of the present purse seine boats have a considerable cruising radius and carrying capacity and they show signs of development in these respects as well as with regard to economy of operation. The reduction of the cost of operation by the installment of crude oil engines, for instance, will probably imply a considerable increase of the radius of action of these boats.''

Purse seine methods and gear.

It is naturally of importance to know something of the methods of the fishery which is under investigation, and Dr. Skogsberg briefly describes these, as follows:

''The term 'purse seine boat' has been used in this report in the restricted sense commonly employed in southern California, i. e., it refers to rather large boats generally of between twenty-four and forty-two gross tons, furnished with turntables upon which the seine is piled, and operating a seine of the type described below. The boats are about 65 feet long, 15 feet wide, 7 feet deep, and are powered with fifty to eighty-five horsepower engines using distillate, distillate and gasoline, or, in a few, crude oil as fuel. During the last few years the building of such a boat has cost between ten and fifteen thousand dollars; in exceptional cases as much as twenty thousand dollars has been paid.

''The crew consists of the captain and six or seven men when fishing for 'whitefish,' but during the tuna season one or two additional men are carried because of the greater size and weight of the tuna seine.

''Two purse seines are required, one for the catching of bluefin tuna and one for 'whitefish'; that is, barracuda, white sea bass, and yellowtail. The tuna seines are about 240 to 320 fathoms long and 23 to 34 fathoms deep, stretched web, and the web is stronger and has larger mesh than that of the whitefish seines. The latter are about 200 to 250 fathoms long and 12 to 24 fathoms deep, stretched web. A new purse seine costs on the average between $4,000 and $5,000. The web of the tuna seine, which is the most expensive part, must, as a rule, be renewed every season, and in the whitefish seine every other or third season. It happens not infrequently that smaller or larger parts of web and ropes are lost by accidents caused by submarine rocks, strong currents, and so forth."

Dr. Skogsberg, in an appendix to his report, presents a careful and detailed technical description of a purse seine net, materials, construction, and use. To quote briefly, "* * * a purse seine is built like a long shallow curtain without any bag in the middle. Its upper edge is buoyed with numerous corks on a strong rope, the cork line, which keeps the seine floating with the cork line at the surface of the water. Its lower edge is weighted with numerous leads on a light rope, the lead line. * * * Along the entire length of the lead line there are a great number of uniformly distributed rings, the purse rings, fastened to the lead line with short ropes. * * * Through these rings runs a heavy rope, the purse line, the ends of which are tied to loops at the ends of the cork line. * * *

"The purse seine is piled on the turntable in the stern of the boat. A skiff is towed behind. When a school of fish is to be corraled, the skiff is released while the purse seine boat is running full speed, and its weight drags the end of the net into the water. As soon as the seine has been laid out in a huge circle around the school, the ends of the purse line are untied and the bottom of the net is closed with all possible speed by the pulling in of purse line, which is done by winch. The seine is then hauled in from the skiff end until the fish are concentrated in the bunt end of the seine, from where they are landed on the purse seine boat by means of a dip net."

History of purse seine fishery.

The reviewers have taken the liberty, for the sake of popular interest, of adding a few remarks, not contained in the report, on purse seine fishing in other localities, showing that this method is by no means a novel or local development in California.

The first purse seine is reputed to have been invented in the State of Rhode Island in 1826 and was used in the mackerel fishery. It was undoubtedly merely an improvement over the older types of gear then in use, but its success led to great expansion of the mackerel fishery, and it is now used extensively from Cape Hatteras to the bay of Fundy and the St. Lawrence. The net was soon adapted to the menhaden fishery and is now, and long has been, the chief means of capture of the menhaden throughout the middle Atlantic states.

The purse seine was introduced into Norway in 1878 by a Gloucester, Massachusetts, fisherman who went to Norway to engage in the annual mackerel campaign, and in order to compete with the Americans the Norwegian government distributed purse seines among its own fishermen, and had full descriptions of the gear published. The mackerel purse seines in Norway were soon adapted to the herring fishery, and that method is now one of the chief means of capture of that fish.

From Norway, purse seines were introduced into England, but they are used only to a limited extent in the West Country in fishing for pilchards (sardines). In other sardine fisheries of Europe, however, the purse seine plays an important part. In Spain the purse seine is the most efficient gear used, and in Portugal the purse seine ("cerco americano") and a kind of fixed gear yield the bulk of the catch of sardines in the winter and in the summer of *Caranx trachusus*, a relative of our "horse mackerel." In France alone are purse seines not used, for there the introduction of improved gear in the fisheries is prohibited by law. Purse seines of the ordinary type along with "improved purse seines" are also used in Japan for the capture of mackerel, tuna, and sardines.

On the Pacific coast of America, purse seining has reached its highest efficiency in the great salmon fishery of the Puget Sound region, and in southeastern Alaska. From this, the southern California purse seine fleet has been largely recruited. That for the salmon is probably the oldest purse seine fishery in the West, and is reported by Cobb* to have been started in Puget Sound by Chinese in 1886. The first gas-powered purse seine boat was first used on Puget Sound in 1903, and the industry rapidly increased from then on, but a power boat of almost modern type was built ten years earlier at San Pedro and used for purse seining for mackerel, sardines, barracuda and other fish. The same method was used in the Monterey sardine fishery at the beginning of its modern development in 1903.

The report takes up the history at this point: "The purse seine fishery in southern California was begun as early as 1893. In that year the first purse seine boat, appropriately named 'Alpha,' was built at Los Angeles for operations in our waters. * * * In 1895 and 1898, two other purse seine boats were built at the same place, but they fished in southern California waters for a few years only. * * *"

Purse seine fishing on a relatively large scale was not started in southern California before 1915, when five boats, all built at Los Angeles, began operations. The following year two were built and in 1917 two more were added to the fleet. During these years barracuda, white sea bass, yellowtail, and mackerel were caught, but practically no tuna. Their success attracted fishermen from Puget Sound, and in 1918, eight purse seiners from the north arrived and with eight more locally built boats started fishing for "whitefish" and tuna as well, which proved quite successful.

Expansion in the purse seine fishery paralleling the war boom in other lines continued, reaching a peak of production in 1919, but continuing to expand in equipment until 1920. More boats came from the north, building increased at San Pedro and San Diego, and in 1920 between 100 and 125 purse seine boats were operating in local waters. In 1919, enormous catches of bluefin tuna were made, netting rich returns for the fishermen and boat owners, and the "whitefish" operations were equally successful. In 1920, however, the total bluefin yield was about one-third less than in the previous year, and the proportionate return decidedly less on account of the increased numbers of boats fishing. The yellowtail fishery fell, due to lack of demand, and the slight increase in the white sea bass and barracuda catch hardly balanced the season's failures. As a result, many boats returned to northern waters.

The reverses of 1920 were only aggravated by the failure of the 1921 season. Operations for tuna, barracuda, and yellowtail were unsuccessful and only the yield of white sea bass exceeded previous years. The number of boats operating was still further reduced and building was practically stopped. By 1922 only fifty boats were operating for tuna and, although the yield was somewhat better than the previous year, only a few were comparatively successful; most of them did not even cover their expenses for equipment, upkeep and operations. The 'whitefish' fishery of 1922 was a moderate success, sixty-five boats operating during a longer or shorter period during the year.

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*Cobb, John N., The Pacific Salmon Fisheries, Appendix III, Report of the U. S. Commissioner of Fisheries for 1916, p. 80. Washington, 1917.

Since 1920, a decided change has taken place in the ownership of the fleet. The amount of money invested in the purse seine boats in 1920 probably approximated two millions of dollars. The larger part of this money, representing life savings, was invested by the fishermen themselves. During 1920, 1921 and 1922, continued reverses were met by increased loans to meet operating expenses, and actual financial control of the boats and gear gradually passed from the fishermen to banks and canners, by means of mortgage, foreclosure and outright sale. At the end of 1922, only about half a dozen purse seine boats of southern California were independently owned. "This fact should be remembered when purse seine fishermen are denounced as aliens prospering at the expense of Americans.

"The decline of the purse seine industry in southern California was certainly not caused by the overfishing of the species on which it depends," as is shown in this report. Many circumstances have contributed to bringing it about which can only be enumerated here. "The cost of operation, which during the last years of the World War had become extremely high, showed little tendency to fall during 1919–1921. At the same time the intense competition between the many boats brought about a recurrent oversupply in the markets, causing a considerable decrease in the wholesale prices of fish. Strikes broke out among the boat pullers during the best seasons. Canned yellowtail proved to be unsuccessful in the market. * * * The bluefin tuna operations of 1921 and 1922 failed, probably due to natural fluctuations as well as moderate demand. It may be just to say that the purse seine industry became a victim of the economic crisis following the war boom."

Fishing ports, and relative importance.

As a means of estimating the relative importance of purse seines and other gear, and as a possible means of understanding various objections raised against purse seining, it is useful to consider the destination of the purse seiners catch. "Of the sixty-five purse seine boats operating in southern California waters in 1922, only two had San Diego as their home port, the rest belonging to the Los Angeles fishing fleet." Of course, the report continues, a fishing boat does not always deliver its catch at its home port, but it probably holds true that the fishermen pick as their home port the place where they can and do sell most of their products. Of the three species caught chiefly by purse seines, barracuda, white sea bass and yellowtail, 40 per cent of the total landings at the two ports, for 1919–1921 from local waters, was landed at San Diego, and 60 per cent at Los Angeles (Los Angeles County). The predominance of Los Angeles as a fishing port is further emphasized by adding the great Mexican catch landed in California. Of the average annual catch (1919-1921) of 3,323,000 pounds from Mexico, about 70 per cent was landed at Los Angeles, and of the bluefin tuna, caught almost exclusively by purse seines, Los Angeles County received in the same period practically all of the catch.

Obviously, the landings in Los Angeles are best adapted to an analysis of the purse seine activities.

Species caught by purse seiners.

Dr. Skogsberg considers in detail the relation of the purse seiners to the supply of the separate species, both those handled by the canners and those used fresh, limiting himself to Los Angeles County, for the reasons given above. Of those forms canned, the sardine, albacore and bluefin tuna are most important. Of those used fresh, the barracuda is much more important than other species, but there are also the California halibut, the yellowtail, the mackerel and the white sea bass. The purse seines play a very important or predominant part in the supply of bluefin tuna, barracuda, yellowtail and white sea bass.

Barracuda.

In most years, he says, the barracuda begins to appear in large quantities near the coast (inside the three-mile limit, often just outside the kelp beds), in the beginning or middle of March. During this month and especially in April, they are found in very large schools, a fairly large percentage of which are less than the legal size, and they seem to be limited to a region between the Coronado Islands and a point midway between Oceanside and Point San Juan. Later in the spring these large schools appear to split into smaller units, and in May they begin to appear in other localities, as Newport, or San Clemente and Santa Catalina Islands, and at that time the spawning season begins. During June the climax of spawning is reached and during that month and July the fish are found along the kelp beds of the whole coast of southern California. Spawning takes place as late as August, at least, and during that month and September, or even later, the fishery is to the northward of San Pedro. During the winter months most of the supply is taken in Mexican waters, but there seems very little reason to believe that there is a migration to the southward from our waters, as occasioned catches can be made in them throughout the year, at times from very large schools.

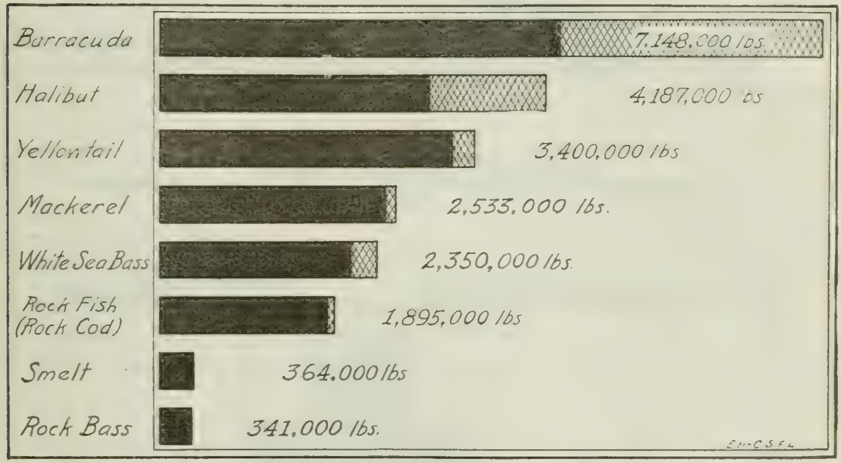

FIG. 24. Yearly landings of the more important market fish in southern California. Values are the average yearly total amounts for the period 1919–1921. Solid black, from local waters; shaded, from Mexico.

The catches made each month are shown on the accompanying graph (Fig. 25), made from data given by Dr. Skogsberg, and it will be noted that heavy catches of local fish are made in April, May and June, but that during the balance of the year the large catches come from Mexican waters. It is pointed out in the report that the alternation of the local and Mexican supply is highly advantageous, and that the latter has been increasing at a rapid rate.

The relation of the purse seiners to the supply of barracuda has been carefully analyzed from statistical records of the Fish and Game Commission by Dr. Skogsberg for the first six months of 1922, and he supplements this by evidence gathered as to the remaining months from various sources. During January, February, March and April, as well as October, November and December, the purse seine fish form the greater part of the catch, varying from 96 per cent in January to 85 per cent in March. This was mainly Mexican fish, not local, save during April. But during May and June, also during July and part of August, the small boats played the chief role, bringing in local fish only. "The small boats—the gill net and round haul boats—are capable of furnishing the markets at San Pedro with a rich supply of barracuda only from the middle of May to the middle of August. They depend almost entirely upon local waters for their catches. During the rest of the year the markets are absolutely dependent upon the purse seiners for their supply of this fish. The fish landed during this period is to a very large extent of Mexican origin."

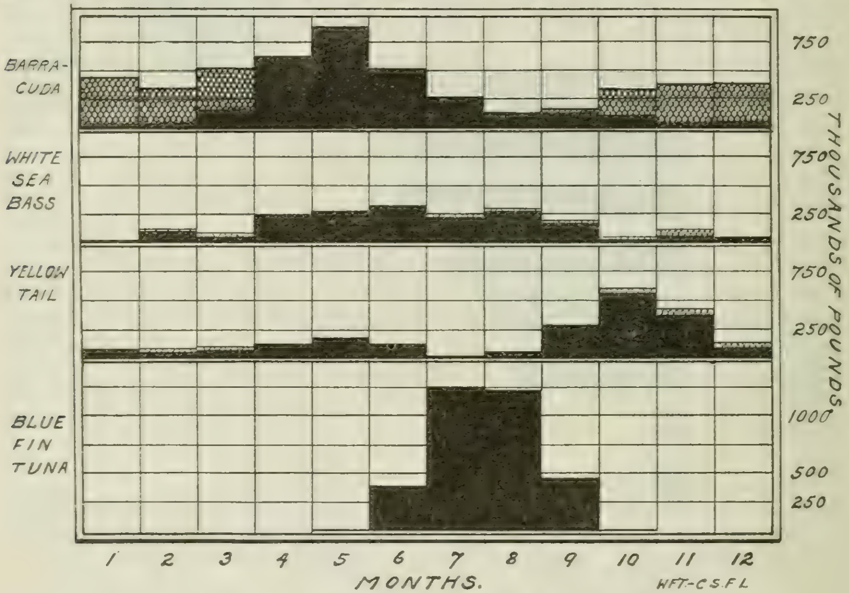

FIG. 25. Catch of chief purse-seined fish in Los Angeles County, according to months. Fish caught in local waters shown in solid black, those in Mexican, shaded. Quantities shown are averages for 1919, 1920 and 1921, save those for bluefin tuna, which are values for 1922 only.

It is especially noted that the months during which the smaller boats —not purse seiners—bring in their large catches of local fish are parts of the spawning season, and that the purse seiners draw heavily on the local supply during April only. The purse seiners therefore, it might be concluded from Dr. Skogsberg's report, although he does not so state, are actually assisting in the conservation of our overstrained local supply of barracuda by equalizing the demand on Mexican and local waters, and by drawing upon the fish during the winter months. Only during April is this not true, for then large supplies of small local fish are taken by the purse seiners.

Dr. Skogsberg is, from a consideration of all available evidence, unable to see any promise that the small boats could replace the purse seiners during the winter months.

The white sea bass. The white sea bass fishery bears a certain resemblance to that for the barracuda. The six summer months, April to September, yield the heaviest local catches, and the catch is not as concentrated in point of time as is the local barracuda catch. During October, November, December and January the catches are small, particularly the local ones. As a whole, the catch of Mexican fish is relatively unimportant, the percentage varying in the years 1917 to 1921 from 3.5 to 19.9.

The purse seiners provide the greater part of the supply of white sea bass landed in San Pedro especially in the winter months. The percentages for the first six months of the year 1922 were: January 98 per cent, February 84, March 70, April 71, May 60, and June 11 per cent. During July the small boats still brought in large quantities, but during the remainder of the year the purse seine predominates. An estimate of 45 per cent of the total catch as of purse seine origin is not wide of the mark. The purse seiners do not, therefore, have the same importance in the white sea bass fishery as in the barracuda fishery. Nevertheless, they furnish the markets with very large amounts of white sea bass, and during the winter months they are almost the only ones landing this fish.

Yellowtail. The occurrences of the yellowtail is also in general similar to that of the barracuda, the fish appearing first in the southern districts, according to Dr. Skogsberg's information, but the maximum catch of yellowtail is in the fall, when the barracuda have become scarce. This may possibly coincide with the spawning season, but the data in his possession are not sufficient to lead to a conclusion. September, October and November yield the heaviest local catches. The summer months are relatively poor. Mexican fish plays a very small role at any part of the year, between 88 and 97 per cent being of local origin in the several months, but the Mexican supply is steadily increasing. Of the total of the species landed in San Pedro by far the greater part is brought in by purse seine boats, an even higher percentage, in fact, than in the case of the barracuda, and the importance of the purse seines is, again, greatest during the winter months. The remainder of the catch is landed, for the most part, by round haul boats whose gear resembles that of the purse seiners.

The bluefin tuna. The bluefin tuna fishery shifts to the north in a fashion similar to that of the barracuda and yellowtail, but begins in June, reaches a climax in July or August, and ends in September, making it a highly concentrated fishery. The species occurs in large schools which split up into smaller units while feeding. No ripe spawn has ever been found in them. The purse seiners are almost the sole means of taking this species, which is so important to the canners of southern California. The loss of the catch would fall very heavily upon Los Angeles County canners, but the opinion is expressed that despite this fact the erratic nature of the catch and the low prices realized threaten to drive the purse seiners out of the business.

Purse seines and conservation.

In view of the detailed evidence which Dr. Skogsberg presents, it is evident that the destructive nature of the purse seine has been overrated. The individual fisheries considered show as yet no signs of overfishing which can confidently or even reasonably be laid at the door of the purse seiners any more than at that of any other method of fishing.

"The question as to whether the barracuda is being overfished can not, of course, be settled as yet, no scientific proofs bearing on the problem being available at the present time. A solution of this important question requires a careful statistical analysis of the catches of several consecutive years. Such investigations should be begun as soon as possible. * * * It is evident that the barracuda fishery of California has increased almost steadily from 1889 to 1921. * * * The total yearly catches do not indicate any decline in the natural supply. But the evidence from the increase of the total annual catch is too deceptive to serve as a basis for a conclusion that overfishing is not taking place."

"A shifting of the fishing grounds to more distant regions is often a sign of depletion of the home supply * * *, but * * * practically all the Mexican barracuda landed in southern California are caught during the season of scarcity of local fish; during April, May, June and July, when the local barracuda fishery is most successful, hardly any boats go to Mexico for their fish."

"There is, however, among the more intelligent barracuda fishermen and fish dealers at San Pedro, a very strong feeling amounting to conviction that the toll taken from the supply even now is too heavy and that the stock begins to show decided indications of decrease."

As is indicated in the report, the purse-seine fishermen can not be blamed with the possible existence of overfishing, any more than other gears can, such as the gill-netters, which take such great quantities of barracuda when spawning, and the roundhaul netters which operate in much the same way and with the same effect as the purse seiners. It is probably true that during the months of March and April large catches of undersized barracuda are taken by purse seiners. Dr. Skogsberg was unable to witness any of these and he believes them relatively seldom made. He points out that the question as to the relative value of these small fish in the conservation of the species is entirely unknown. In the great fisheries of Europe enormous quantities of very young plaice, cod, haddock, etc., are taken and marketed, and have been for a great many years. Almost every great fishery, in fact, is wasteful, as witness the halibut fishery in the north Pacific, where more fish are destroyed than are taken.

Furthermore, the fate of these young fish after being caught and liberated is unknown. The author is assured that, when not over-crowded in the net, they survive. But when taken in too great numbers, or gilled in the meshes, they are undoubtedly seriously injured. He, therefore, believes that it would be a mistake to force the fishermen to use large meshes, but that, on the contrary, they should be allowed to use meshes too small to permit undersized fish to gill. This is the more true in that the gilling of fish must be avoided by the purse seiners because of the labor involved, and because of damage to the nets.

The evidence shows, on the whole, that the purse seines assist in conserving our local supplies by bringing fish from Mexico, and by catching winter fish, but that they are perhaps injurious during March and April, although even that is doubtful. They are least harmful during May, June, July and August, when the gill net fishermen take great quantities of spawning barracuda. The restriction necessary should be applied with these facts in mind.

In so far as the white sea bass fishery is concerned, Dr. Skogsberg found few complaints and his opinion is that the purse seiners do no more damage than do others. The proportion of small fish taken is not great, nor is there any feeling that depletion is occurring. About half of the total catch is taken by the purse seiners, and during the winter months as high as 98 per cent is landed by them. They do not bring, however, any great amount of Mexican white sea bass into Los Angeles Harbor. The same remarks apply to the yellowtail fishery, although in that case he calls attention to the fact that the great demand in 1918 demonstrated the rich possibilities of the fishery and conclusively showed the lack of overfishing in the following years.

The bluefin fishery shows no evidence of harmful fishing. "The decline in the bluefin fishery during the last two years may, to some extent, be explained by the low market prices, the possibly increased difficulties of catching the fish and the decrease in the number of the operating purse seine boats. The small number of years (six) during which the bluefin tuna fishery has been carried on, the shortness of the fishing season and the suddenness of the decline make it very improbable that the failure in 1921 and 1922 was caused by overfishing during the two preceding years."

One may summarize Dr. Skogsberg's findings by saying that the purse seines are on the whole no more harmful than other types of gear, and that their activities during the month of April, when they take great quantities of the smaller barracuda may be restricted by proper regulations. He also brings forward evidence showing that they are necessary types of vessels in tapping distant reserves of fish, thus relieving the strain upon our local supplies; that they provide the greater part of our winter supply of fresh fish, and that the whole of the bluefin tuna catch depends upon them. They are less harmful than beneficial, in so far as the conservation of our fisheries is concerned.

From an economic standpoint they meet with several objections, only one of which is dealt with in detail. This, the fluctuations in supply, and the resulting fluctuation in price, is disastrous to both the purse seiners and other fishermen, and is a defect inherent in any method of fishing which makes large individual catches. The correct method of dealing with this, the author and reviewers believe, is by the encouragement of cold storage facilities. The elimination of these fluctuations would remove one of the prime causes of dislike among fishermen for this method of fishing.

The other causes of feeling against the purse seiners may be briefly enumerated, although not all dealt with in the report. There is the usual resentment of fishermen against new fishing methods, the uneasy feeling as to the permanence of supply that is generated in the layman's mind when he sees great individual catches of a species landed, the invasion by the purse seiners of districts reserved by law for the use of the sportsmen, and the fear that the nets in dragging the bottom destroy fish eggs and food. These things can not be dealt with here, although Dr. Skogsberg clearly shows that the latter cause of dislike is not justifiable.

The recommendations as to legislation suitable indicate that a close season during April and May would be effective in preventing the damage to small barracuda, which is the chief cause for the agitation against the purse seiners. Other measures possible and proposed are also discussed, and dismissed. A warning is sounded, that measures seriously injuring the purse seines will simply lead to the great development of the round-haul fishermen, who are indispensable in the sardine industry, but whose nets operate in the same general way and with the same damage to young fish as the purse seines.

The reviewers wish to emphasize Dr. Skogsberg's conclusion that there are a great many questions of a scientific nature still to be attacked before really final conclusions are reached with regard to the condition of our fish supply.

THE BAND-TAILED PIGEON IN YOSEMITE.

By M. Hall McAllister.

Thanks to the national parks and other game reserves where man, the great destroyer, can not get in his deadly work, our game birds and animals have a chance of surviving and becoming an asset for future generations. If fifty or one hundred years ago there had been throughout the Eastern States such game reserves, the now extinct passenger pigeon would still be in existence.

A great variety of birds and animals make their homes in places like Yosemite National Park. Some may be seen in broad daylight, others only at night. When visiting Yosemite it is a good rule, if you wish to see some interesting sights, to get up about a half hour before daylight, say 3.30 a.m. in June or July, and you will find a number of early folk to greet you. Some birds and animals appear at the first streak of dawn and disappear about 6 a.m., as soon as there is the least stir among the camps or dwellings. Visit the horse corrals which are along the north wall, east of Yosemite Falls, and you will probably find a flock of several hundred band-tails feeding there. Bands of deer may be seen in the meadows and glimpses of the furry tribe, including flying squirrels and weasels, may be enjoyed.

The band-tailed pigeon, a wild pigeon of Western States, is found in California the year round. It appears to be increasing in numbers, due to federal and state protection. In the Yosemite Valley pigeons are abundant and may be easily seen by visitors, provided they know how and where to look for them.

These flocks of wild pigeons seek the seclusion of the high trees on the walls of the valley during the day and, therefore, are but seldom seen by the daily visitors. A favorite habitat is on the tall cliff overlooking Vernal Fall on the south and occasionally a small flock can be seen as they are picking up grain on the road which follows the foot of the talus just under Sentinel Rock. This bird feeds largely on acorns, of which there is a plentiful supply.

During the winter months these pigeons do not leave the valley unless the storms are very prolonged, and then they apparently go a few miles down the Merced River canyon, but shortly return to their old haunt.

A very curious sight is sometimes seen during the winter. A large flock of band-tails may be roosting in a tree, when a heavy snowfall comes, which frequently continues all night without a breath of wind. This completely covers the perching birds and in the morning, when they are suddenly disturbed by a passerby, out they fly, causing a novel shower of snow.

The snowfall in the Yosemite is a remarkable feature of this attractive place. John Muir first called attention to the fact that the valley, or great gorge, which it really is, runs east and west, while the strong storm winds blow north and south. Therefore, while a hurricane blizzard may be piling up the snow on the heights, the fall in the valley comes down as gently as if it were at the bottom of a well. And so a heavy mantle of snow is particularly beautiful as it descends with but little wind and sticks fast to the trees and other objects, including, perhaps, a slumbering flock of pigeons.

Band-tailed pigeons are now breeding in various locations in the park. Their nests can be seen on the high cliffs overlooking Vernal Fall and among the pine and oak trees on the walls of the valley. It is a great satisfaction to know that these splendid birds have made their home in a protected area where they are safe for all time.

WHY CANADA AND THE UNITED STATES COMBINED TO STOP SPRING SHOOTING.*

By J. H. FLEMING.

So much has been written about bird protection from the extreme point of view of the reformer that many men of moderate views have got the idea that protection spells total prohibition of shooting, instead of what it really means, the prevention of extermination, and the building up of the reserves of wild life to a point when the sportsman may feel that his future as a sportsman is safe under the regulations of the Migratory Birds Convention Act; while the same law acts as a check on the decrease of the nongame bird population of our country as well.

The extermination of wild life is not by any means confined to North America, it has been world wide, but possibly the results have been more clearly foreseen in Canada and the United States, and early enough to give hopes that with unity of legislation the word *exterminated* need only be written against a few of the birds and animals now in real danger of disappearing. And it is just in this lack of unity of laws (the question of enforcement is another matter) that Canada's efforts to restore the balance of nature by protective legislation is in danger. Animals are not subject to the impulse of migration to anything like the same extent as are birds. Provincial legislation is usually effective in their case, but local legislation for birds has repeatedly proved in the past to be ineffective as a protective measure. Birds pass from province to province and even from continent to continent in their journeys, and they suffer from local conditions as well as from international.

We in Canada are fortunate in that continental legislation is likely to prove a decisive factor in checking the downward movement of many desirable birds, but we must be unanimous, every province should legislate in conformity with the Migratory Birds Convention Act of the federal government of Canada if results adequate to the necessity of the case are to be obtained, and the case is urgent. We are not yet on the road to safety for our birds till every province conforms to the federal act. When that does happen we may then look to the United States to act with us, and we may then hope for the continental enforcement of an act that means results, both to the birds and to the sportsman, results that are bound to be beneficial to both. The convention is not the result of hasty legislation, but the carefully thought out effort of men who have seen the disheartening failure of laws that are purely local, and who know that nothing short of joint action by both the United States and Canada can be effective in building up the reserve of our bird life.

Migratory game birds such as ducks and geese may appear at times to be abundant in some one place, and the natural inference is that they are not decreasing, but the observer overlooks the fact that the old feeding grounds are not now as extensive, particularly in the West, as they used to be, and the birds are crowded into a smaller area. There have been many reasons given for the decrease of game birds. Spring shooting has harried them on migration and consequently they reach their breeding grounds with less vitality than they ought, and they are apt to select the safest breeding grounds and often not the best. Many birds become barren and never reach the breeding grounds at all in consequence of the persecution they have experienced on their northern journey, and it is here that the direct benefits of the Migratory Birds Convention Act will be quickly felt. The birds will arrive in their full numbers and vigor and will select the most suitable breeding grounds, and in consequence the breeding range will be more extended and then, if granted sufficient local protection, there is no reason why there should not be a considerable increase in our migratory game within a few years, but we must give ample protection during the breeding season and local legislation has not in the past done this. It is only by joint action of the United States and Canada that protection over the whole breeding range of many species can be effective. The decrease of migratory game is so apparent that it is a matter of general knowledge, and fortunately the means to check it has at last come to our hands if we will only sink our local differences and accept the guidance of a central and well informed body whose duty it is to administer the treaty on behalf of Canada.

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*Leaflet published by Commissioner, Dominion Parks Branch, Ottawa, Canada.

CALIFORNIA FISH AND GAME.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

October 10, 1923.

"The undoubted solution of the conservation problem is education, particularly of the young. Police methods, however, seem the sole means of controlling the hardened offender."

THE MOST NEEDED THING IN GAME CONSERVATION.

Fish and game administration is not a new thing. California has had a Fish and Game Commission, charged with care of the wild life resources, since 1870. Yet fundamental data that would be most useful in determining what toll can be taken of the various species has not been obtained. No one knows the average age of deer nor the natural death rate. Very little is known regarding the factors concerned in the increase or decrease of a species. Too often, emphasis is placed upon one factor alone, as, for instance, the predatory animals, when, in reality, there may be a multiplicity of factors concerned. Until we have dependable statistics as to the natural rate of increase and the normal death rate, it will be impossible scientifically to administer wild life resources. The most important data obtained in recent years has been that regarding the toll taken by the hunter. Several states now require every hunter to report his kill, and compilations are available showing the number of big game animals killed annually. How large a toll can be safely taken and still leave a sufficient breeding stock is still a matter of speculation. The most needed thing in game conservation is an intensive study of rate of increase and the death rate together with those factors concerned with these phenomena.

KLAMATH RIVER POWER PROJECT HEARING.

The hearing of the application of the Electro-Metals Company was continued before the Division of Water Rights the first of May, R. D. Duke, representing the Fish and Game Commission, one of the protestants. The appropriation was made by Carl Langford in 1908 of 500,000 inches of water flowing in the Klamath River or over four times the mean flow of the Klamath. The point of diversion was Ishi Pishi Falls, Siskiyou County. This appropriation was for the purpose of developing hydro-electric power for use in the reduction of ores in the production of aluminum.

The application of the Electro-Metals Company is for the purpose of having the time extended for a period of ten years within which to complete its proposed development and in order to justify the Division of Water Rights in granting such extension, it is incumbent upon the applicant under section 12 of the Water Act, that "the appropriator or user shall have proceeded with due diligence in proportion to the magnitude of the project."

At the time the appropriation was made there were no trails or roads, the nearest road being twenty-two miles or as far as Martin's Ferry in from the coast, and all materials had to be brought in on pack animals.

No roads were built by the appropriator and the only work done towards putting to a beneficial use this vast appropriation of water, outside of some surveying, was to bore a tunnel 1700 feet long, as yet incomplete. The original plan was to divert the water through this tunnel and through a canal to the proposed power plant below Ishi Pishi Falls, but since then, the appropriators have changed their plans and propose to construct a dam 250 feet high which would close the streams to the passage of salmon and sea-run trout and thus destroy this last large run of these species of fish in this state.

The state owns and operates a fish hatchery on Fall Creek, a tributary of the Klamath River, and an egg taking station at Klamathon where annually an average of five million sea-run trout eggs and twenty million salmon eggs, which are used not only for stocking the Klamath, but also other streams. If this permit is granted it means the end of this source of supply and the practical confiscation of the property of the state as it would become useless.

The Fish and Game Commission is protesting on the ground that this is the last large run of salmon and sea-run trout in California for over ninety per cent of the spawning grounds have been destroyed by the hydro-electric power development, particularly on the Sacramento and San Joaquin rivers, and the only object of the Fish and Game Commission in protesting is to save these fish for the purpose of propagation and from extermination.

The government has constructed a road down the Klamath River which for miles runs through a forest reserve and is going to be one of the scenic trips of the state, the principal attraction of which is fish and game.

The application of the appropriator shows the power is to be used to develop a private enterprise in the manufacturing of aluminum and it does not seem possible that the time has come in this state when the people will suffer the last large run of salmon and sea-run trout to be absolutely destroyed by a private greed.

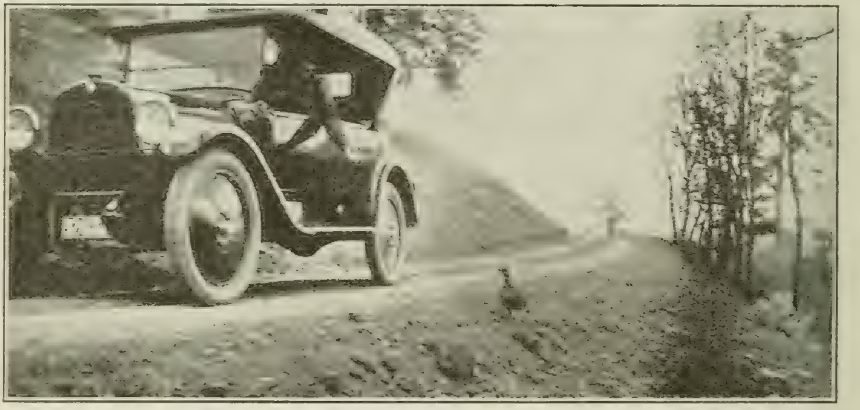

FIG. 26. A tame sooty grouse, Scott's Valley, Siskiyou County. Photographed April 24, 1923, by A. E. Culver.

BUREAU OF FISHERIES SUPPORTS COMMISSION'S STAND ON KLAMATH POWER PROJECT.

The following letter from Commissioner of Fisheries Henry O'Malley supports the stand of the California Fish and Game Commission as to the feasibility of a fishway over a two hundred foot dam:

MR. W. H. SHEBLEY,

In charge, Department of Fish Culture,
Fish and Game Commission of California, Sacramento, Cal.

DEAR MR. SHEBLEY:

I acknowledge the receipt of your letter of March 27 and note that your Commission is endeavoring to amend the present fishway law of California so as to enable the Commission to use its judgment in regard to establishing hatcheries in lieu of fishways when in their judgment the dams are placed too near the mouths of the rivers, so that salmon can not properly mature their eggs when intercepted that low down on the river.

I further note that a statement has been made to the effect that the Bureau, or I, have approved of a fishway proposed by the Electro-Metals Co. I want to say to you very decidedly that I have not approved any type of fishway. I have consistently adhered to the statement that it is practically impossible successfully to pass adult salmon over a dam or obstruction of a greater height than 30 feet. There are one or two instances where they do go over a dam higher than this, but the cases are rare, and none of them exceed 40 feet.

The dam of the Portland Railway, Light and Power Company, located at River Mill, Oregon, is something over 100 feet in height, if I recall the figures correctly, and to my personal knowledge, borne out by the statements of Mr. Mitchell, our superintendent at Clackamas, Oregon, station, we have never known a salmon to successfully negotiate the fishway. During the season when we are operating for eggs below the dam we do not even take the trouble, in recent years, to blockade the fishway because it presents a sufficient barrier in itself. This fishway was constructed by the Portland Railway, Light and Power Company in good faith and from the best plans available at that time, but it has not proven a success.

The proposal of the Electro-Metals Co. to construct a fishway in rises of 30 or 40 feet, and then establish small lakes or resting pools is an entirely new plan, and it would be impossible for me to state whether or not it would prove successful, but I would not want to recommend it for a river which is supporting a commercial run of salmon that would be destroyed if it were not to prove successful. It seems to me that it should first be attempted on some unimportant stream to find out whether the plan would be practicable.

We have one or two men in the Bureau who are studying fishways with the idea of attempting to develop something that is practical for the high dams which are under contemplation at various points, but up to the present time nothing that approaches a satisfactory device has been suggested.

If you desire to use this letter officially, you may do so, and I shall be glad to give you any other information which we have available at the Bureau.

Very truly yours,

Henry O'Malley,
Commissioner.

IN MEMORIAM.

WILLARD ODION FASSETT.

Willard Odion Fassett departed this life April 10, 1923. He was a son of the late Thomas Odion Fassett, U. S. N., and Susan Knight Fassett. He was born April 4, 1862 at Brooklyn, New York, and came to San Francisco with his parents in 1867. Later the family moved to Vallejo.

Mr. Fassett graduated from the Vallejo High School in 1879. Shortly after this he entered the service of the United States Navy as a machinist apprentice in the steam engineering department at Mare Island, where he completed his apprenticeship and was employed for a number of years at the trade in the government service. He was a lover of nature and the great out-of-doors had a fascination for him.

He entered the employ of the California Fish and Game Commission as an apprentice fish culturist in 1896 at the Battle Creek salmon cultural station. Thereafter he took an active part in all departments of fish cultural operations, having been employed as foreman of the Commission's egg collecting station at Verdi, Nevada, as foreman and assistant in fish cultural operations under E. W. Hunt at the Tahoe stations, and as messenger in distribution work and other capacities at the Sisson hatchery, Klamath River stations and other hatcheries and egg collecting stations. Mr. Fassett was appointed superintendent of the Price Creek Hatchery in Humboldt County in 1900, where he was in charge during all the years that this station was in operation. It was a hard station to operate

W. O. Fassett.

owing to the friable nature of the soil through which Price Creek flowed forming immense deposits of earthy matter in the water supply that caused many days and nights of anxiety on his part lest the fish and eggs in his charge be destroyed.

When the Price Creek Hatchery was abandoned in 1915 and the new hatchery near Ft. Seward established, Mr. Fassett was placed in charge of the new station. In 1920 Mr. Fassett was placed in charge of the northwestern division of the Fish and Game Commission's fish cultural operations, which included all the stations in Mendocino and Humboldt counties, consisting of Ft. Seward Hatchery, Ukiah Hatchery, Snow Mountain Egg Collecting Station and the experimental station near Branscomb on the South Fork of the Eel River. Mr. Fassett continued in charge of these stations until the date of his demise.

Mr. Fassett was a loyal and faithful employee of the Fish and Game Commission. He never neglected the most exacting duties connected with his work, always having in mind the success of his undertakings. His knowledge of the natural history of the different species of fishes that he handled in his work was of great value to him and assisted greatly in the success that he made of his fish cultural work. His mechanical training was of great assistance in the construction work at the different stations that were under his charge. Untiring in his efforts in all lines of fish culture, conscientious and dependable at all times, he was one of the old, faithful employees of the Fish and Game Commission, who made the work of the Commission known all over the country for its efficiency.

Mr. Fassett was married to Mary E. Weymouth in San Francisco, September 3, 1899. He leaves to mourn his loss his wife, one son, Weymouth Fassett, two brothers, Thomas and Philip Fassett of San Francisco, besides a host of friends, for his genial nature, generous disposition and his charity toward all men made him loved and respected by all who knew him.

In the passing of Willard Fassett the state has lost a good citizen, his wife and son a kind and loving husband and father and the Commission a dependable and faithful employee. W. H. S.

THE STEINHART AQUARIUM.

It is gratifying to the Commission, and will doubtless be of much interest to our readers, to know that the splendid new Steinhart Aquarium in Golden Gate Park, San Francisco, is to contain a demonstration hatchery for use by the California Fish and Game Commission. Ever since its organization in 1870, the Commission has been very active in introducing new species of fish suited to various local conditions, and in the artificial propagation on a large scale, of both the introduced and the most desirable native species of food and game fishes. Valuable scientific studies in the life histories of many species and in the problems of conservation and propagation have been conducted by the departments of commercial fisheries and fishculture in this connection. Some of the most important of these investigations are now in progress. The purpose of all such activities is to perpetuate and to increase the value of California fisheries, as well as to meet the demands of an increasing population of anglers for the delectable sport of fishing. Results of the Commission's efforts along this line have been probably the most successful ever recorded by any state in the Union.

This miniature hatchery in the aquarium is to be well equipped for showing all of the processes, methods and practices used in the artificial hatching and rearing of fish. The Fish and Game Commission expects to cooperate by detailing one of its fishcultural experts to take charge during appropriate seasons and to give information. It is anticipated that this feature of the aquarium will be much enjoyed and appreciated by the thousands of persons who will visit the numerous exhibits.

A biological laboratory, equipped so that investigators, professors, high school teachers and others may come and study any problems in which they are interested and which can be studied with aquarium material, is also a part of the aquarium plan. This offers a resource of much value to teachers and their students and one which it is hoped will be widely used.

We are pleased to present the following description of the aquarium and a brief history of this gift to California:

"Construction work on this aquarium, which was begun in April, 1922, will probably be completed early in July. The California Academy of Sciences has already begun collecting and placing in the tanks and pools the fishes and other aquatic animals that will constitute the permanent exhibits. There are in the stock tanks now, quite a number of aquatic animals of various kinds including one small California sea lion, one horseshoe crab, some thirty turtles, representing eight different species from Lake

Maxinkuckee, Indiana, and numerous aquatic reptiles and amphibians from the states of Washington and Texas, including a three-foot alligator from the latter state. To assemble and install the exhibits necessary fully to stock the aquarium will require a month or longer, but it is hoped that the installations will all be completed and the aquarium ready to open to the public within a few months.

"There are 57 large tanks, about 40 smaller balanced aquariums or tanks, one large indoor tropical swamp, and five large outdoor pools for sea lions, fur seals, leopard seals, porpoises and fishes too large to put in the indoor tanks. Both fresh water and salt water fishes will be shown. Four kinds of water will be used. There will be tanks with fresh water of the local temperature for local fresh water fishes, and others with fresh water cooled to suit trout, salmon and other cold water species. Then there will be other tanks with salt water of the local temperature for the salt water species of our coast, and other tanks with water heated to suit the gorgeously colored tropical fishes from the Hawaiian Islands. About a dozen large tanks will be devoted to tropical species.

"The indoor tropical swamp is the first thing that will attract the attention of the visitor as he enters the building. This swamp is on the main floor and is about 25 by 45 feet. The side opposite the visitor will be a moss-covered bank down which water trickles gently and artistically. At the other side the water will be two or three feet deep. Lying about in the swamp will be several old moss-covered logs, stumps and rocks on which turtles, watersnakes, frogs and salamanders can crawl out. And there will be aquatic plants of various kinds growing in the swamp, while ferns, climbing vines and other suitable plants will cover the walls to a height of 30 to 40 feet on three sides of the swamp, and from the skylight girders above the swamp will be suspended orchids and other beautiful tropical epiphytes.

"In the 57 large aquariums and the 40 or more smaller ones it is hoped to show a great many of the most interesting and important fishes found on the west coast of America and in the Hawaiian Islands, as well as many kinds from other countries. It is also the intention to show as many species of turtles, watersnakes, frogs and salamanders as possible, including the water-dog from the Great Lakes, the alligator snapper from Arkansas, and that strange animal from the Mississippi River, the hellbender, or, to speak more reverently, the "sheol curver."

"For this great educational institution, San Francisco, the Bay region and the entire state are indebted to Ignatz Steinhart, banker and philanthropist of San Francisco, who died May 15, 1917. In his will Mr. Steinhart left $250,000 to the California Academy of Sciences for a public aquarium on condition that it be located in Golden Gate Park adjoining the Museum of the California Academy of Sciences and the 'management, superintendence and operation be in charge and under the direction of the California Academy of Sciences.'

"The executors, Mr. Jesse W. Lilienthal, Jr., and Mr. John I. Walter, paid over to the Academy the full $250,000 in one check in December, 1919, and the trustees of the Academy loaned the entire amount on the day it was received at a good rate, the interest payable monthly. Whenever an interest payment was received the amount was invested in government certificates, with the result that more than $53,000 interest has already accrued.

"Mr. Steinhart originally planned to put $75,000 to $125,000 into the aquarium building and its equipment. But the larger amount named in his will and the business-like handling of the money by the board of trustees of the Academy has made it possible to put $303,000 into it, and to provide a very much larger, better equipped and more beautiful aquarium than was originally contemplated or possible.

"Dr. Barton Warren Evermann, the director of the musuem of the California Academy of Sciences will also be the director of the Steinhart Aquarium, and Mr. Alvin Seale, director of the Manila Aquarium for several years, will be superintendent and in immediate charge.

"Mr. Steinhart had for several years contemplated establishing a public aquarium but finally practically abandoned the idea until Dr. Evermann had an interview with him on March 8, 1916, at which time Mr. Steinhart said that he had met with so many difficulties of one sort or another that he had abandoned the aquarium idea and had about decided to devote the money to another and entirely different purpose. Dr. Evermann left him that evening with the feeling that there was no hope of Mr. Steinhart ever giving any money for a public aquarium. But two days later Mr. Steinhart telephoned Dr. Evermann to come and take luncheon with him at the California

Market. The invitation was, of course, accepted and almost the sole subject of conversation during the luncheon was aquariums. Other luncheons followed at rather close intervals. On April 5th, Mr. Steinhart stated to Dr. Evermann that he had finally decided to establish an aquarium in Golden Gate Park and under the California Academy of Sciences, and on September 13, 1916, at an aquarium luncheon held at the Palace Hotel, at which Mr. E. O. McCormick presided, Mr. Steinhart made the first public announcement of his decision.

"From that date the matter moved rapidly. A charter amendment was adopted by the city and county of San Francisco which authorizes and directs the board of supervisors to provide in the budget and to pay over to the Academy of Sciences the funds annually required for the maintenance of the aquarium.

"San Francisco and the entire state are to be congratulated on the prospect of early completion of such a useful educational institution as the Steinhart Aquarium is sure to be. What a fine thing it was for Mr. Steinhart to make this possible! What a splendid and enduring memorial the Steinhart Aquarium will be! The name of Ignatz Steinhart will ever be held in grateful remembrance."

IT ALL HELPS.

Although we many times hear of readers of California Fish and Game who pass on their copy of the magazine to others to read, it has been seldom that we have met the enthusiasm shown by a motorman of San Francisco who recently stated that upon the receipt of California Fish and Game he reads it from cover to cover, allows his wife to read it, and then his son. After home consumption, he sends it to a teacher in a country school in northern California with the request that it be returned. Upon its return, by this time rather worn and soiled, it is finally forwarded to a friend in Michigan.

Successive attempts to eliminate a large number of those receiving the magazine and consigning it to the wastebasket have shown that 96 per cent of our readers actually read the magazine and invariably find and return the postal card which assures their continuance on the mailing list.

HAWK AND OWL BOUNTIES.

In a leading editorial, "Evils that Lurk in the Bounty System," *Bird-Lore*, Vol. XXV, No. 2, March-April, 1923, makes a strong appeal for discrimination between the harmful and the beneficial species of birds where bounty laws are in operation or are being advocated. It is pointed out that for many years it has been the custom in western Europe to employ keepers, for the private game preserves, whose duty it is to destroy birds or animals which prey upon the game within the preserves. Such birds or animals are usually classed as "vermin," and include hawks, owls, rooks or any bird which is thought to be destructive to game.

This custom is also in more or less general practice in this country and its influence is seen in the agitation for "bounty laws" in various state legislatures. Some states have such laws in operation, as for instance, Virginia, which pays a cash reward on hawks, owls and crows. Of course, it is but natural that these birds were indiscriminately condemned in Europe a century ago because scientific investigation had not then determined the food habits of the different species. Now, however, through studies made by the United States Department of Agriculture, Bureau of Biological Survey, it has been found that really a small minority of these birds prey upon game birds. Of the 19 species of hawks and 21 species of owls in North America, the sharp-shinned hawk, Cooper's hawk, goshawk (not abundant), the great horned owl and the snowy owl are the serious offenders. The Biological Survey has gone on record as not approving the bounty system, but even if it were considered a good thing for really destructive birds or animals, why should public money be paid for the killing of the many species of hawks and owls that live almost entirely upon grasshoppers, mice, rats, gophers and other pests that work havoc upon the crops of the farmer and orchardist.

The bald eagle, emblem of American independence, is also among the unprotected birds in some states. In Alaska, where the eagle is very abundant, it is stated that more than 18,000 eagle bounties have been paid. If we must have bounty systems, why can not the bounties be confined to the birds that have been proven to be detrimental to game or insectivorous birds. With all of the literature available on the subject, there is no reason why anyone should not be informed as to the harmful and beneficial species. Bounties, if paid at all, should be paid only on the undesirables.

GAME LAW ABSTRACTS.

It has been the custom of sporting goods houses to issue small cards giving an abstract of the game laws. In order to have these cards ready for the angling season they are rushed through before an authentic synopsis of the new laws has been made by the Fish and Game Commission. As a result, serious mistakes are made and the Commission has the greater difficulty in law enforcement. Several new laws were placed upon the statute books by the 1923 legislature and every sporting goods house planning a game card should obtain an official tabulation from the Fish and Game Commission.

RABBIT HUNTING AND QUAIL.

Southern California is greatly disturbed over the quail situation. In the early days, the valley quail was a very abundant bird, but the species seems to be disappearing all through the southern counties. Doubtless, there are many causes for this decrease, the destruction of food and shelter being, perhaps, the prime cause. Among the minor factors concerned may be pointed out the situation which southern California still maintains as regards rabbits. Although northern California some years ago gave protection to the rabbit so as to give no excuse to anyone to have a gun in the field before the opening of the quail season, southern California, on the other hand, has persistently requested no protection for rabbits on the plea that they were very destructive to crops. As a result, law enforcement has been difficult and the alien gunner, with the constant excuse of "hunting rabbits," has been able to kill quail out of season. On the statute books the rabbit continues to hold a unique position—in one section it is branded a destructive animal and given no limit, yet in another section limit laws hold and sentiment favors protection.

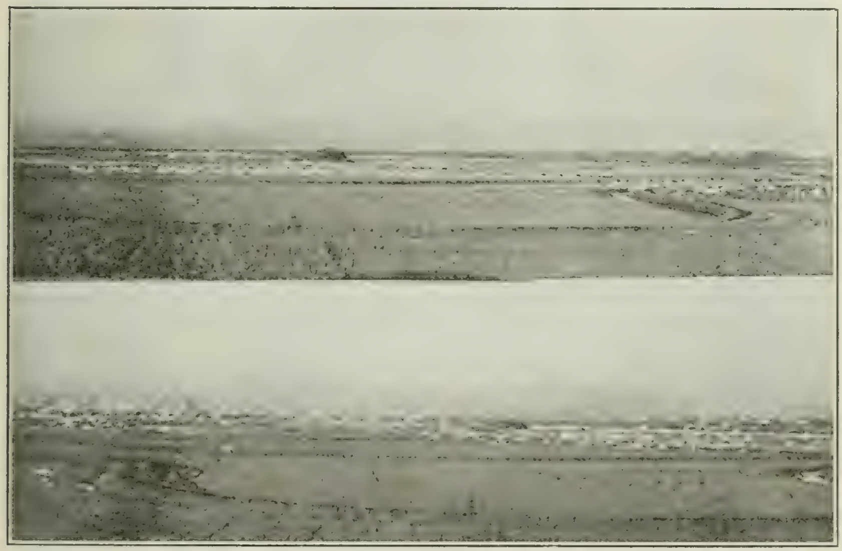

FIG. 27. Whistling swans feeding in rice stubble fields near Richvale, Butte County, November 19, 1922. These birds were particularly abundant in the Sacramento Valley last winter. Photograph by George Thompson.

VIOLATORS MOSTLY FOREIGNERS.

Scan the list of game law violators and it will be found that a very large percentage of them are foreigners. In fact, 75 per cent of the violations are either willful evasions by aliens or are traceable to ignorance. The most effective remedies are an alien gun law and education. These measures would greatly aid law enforcement and effectually reduce violations.

An educational program has been adopted in California but the alien gun law, found so useful in other states, is not to be found on our statute books.

STRIPED BASS IN OAKLAND LAKE.

During early March, while dredging operations were in progress at Lake Merritt. Oakland, the gates which govern the tidewater used in forming the lake were closed for a time. A large number of striped bass which had found their way into the lake from the creek were shut off from exit and soon sickened in the brackish water of the lake. Fishing for them was popular at first, but those taken were unfit for food and, therefore, at the suggestion of the Board of Health, all permits for fishing were rescinded. Fish of four or five pounds in weight were taken.

DO NOT MOLEST FAWNS.

The formal opening of the vacation season in California was celebrated with the opening of the trout season, and mountains and woods and streams extend their invitations. Camp outfits have been assembled and the exodus to the great out-of-doors has begun; daily this movement gathers impetus, and in but a short space of time tourists will have taken possession of all of the favorite campsites in the whole mountain area of California.

The deer, too, are now leaving their winter quarters in the sheltered places below the winter snow line and are following the receding snows to the higher altitudes where they will take up their summer homes. And, arriving on the summer range, the deer family will set up the manner of housekeeping that is peculiar to their kind.

Male deer all shed their horns during the winter and the principal business of the buck during the summer is to grow another set of antlers that may adorn some hunter's den this year, or be the foundation for some of the stories that only a deer-hunter knows how to tell. The older bucks soon leave the other deer and seek solitude in the high inaccessible mountain regions where they stay until after the opening of the deer season, and the coming of the hunter.

Does and yearlings remain in the little mountain valleys and glades and along the streams and near lakes. It is here that the fawns are born, each doe raising one or two; protection and conservation of the yearly 'crop' of fawns is absolutely necessary if the sport of deer hunting is to be perpetuated.

For the first few days after the fawn is born the mother deer will place her baby in some secluded spot where it will lie and sleep most of the time—the mother deer will go away, but will return to feed her baby periodically. The tourist wandering through the woods, or the angler along the stream may, perchance, happen upon a newly-born fawn. Immediately he is intensely fascinated at the sight of the little fellow, for while the young of all wild animals are attractive, none is more beautiful than the fawn. The little warm ball of soft, spotted fur, the small slender nose, the restive ears and the large wistful eyes are irresistible attractions; and many a person after gazing on this beautiful creature is possessed by the desire to have—and to hold. However, the law injects itself at this point and says specifically that every person who takes or has in his possession any spotted fawn is guilty of a misdemeanor, and upon conviction, shall be fined in a sum of not less than $50, or sentenced to jail, or both.

While occasionally a fawn may be left an orphan, such instances are rare. A very young fawn may appear to be "half-starved," but such is not the case and the youngster soon acquires sufficient strength to accompany the mother. Provision is made by Mother Nature to protect the little fawn from predatory animals for the scent sacs are not developed for a number of days after the fawn is born; during which period a good deer dog may pass within a few feet of a fawn without being aware of its presence, as there is no scent.

From time to time, certain well meaning but misguided persons will pick up a little fawn discovered in the woods believing it to be abandoned because the mother deer does not happen to be in sight at the moment, and such person will then write to the Fish and Game Commission for a permit to keep the animal. This can not be granted.

While on your trip to the mountains, should you be so fortunate as to see a young fawn you should appreciate your privilege to look upon one of Nature's most wonderful creatures, and you should be grateful and go away without disturbing the little animal. Reducing any deer to captivity is not desirable as most people soon tire of a deer as a pet, for the affections of an adult deer are decidedly fickle. But when the animal has once been kept a captive it can not be liberated again for it has lost its fear of man and can no longer take care of itself; thus, the deer which has been picked up as a little fawn must be retained in captivity all of its life; which is certainly an ignominious existence for so noble an animal.—Roy Ludlum, Sacramento, California.

A WARNING.

After every session of the legislature, hunters and anglers find themselves in serious trouble owing to the fact that they have not secured correct information regarding new laws passed. The newspapers, in reporting new laws passed by the legislature and signed by the Governor, do not explain that these laws do not go into effect until 90 days after the close of the legislature, which this year ended May 18th. In spite of statements to the contrary, the trout limit remains the same and relatively few changes in laws went into effect on August 17th.

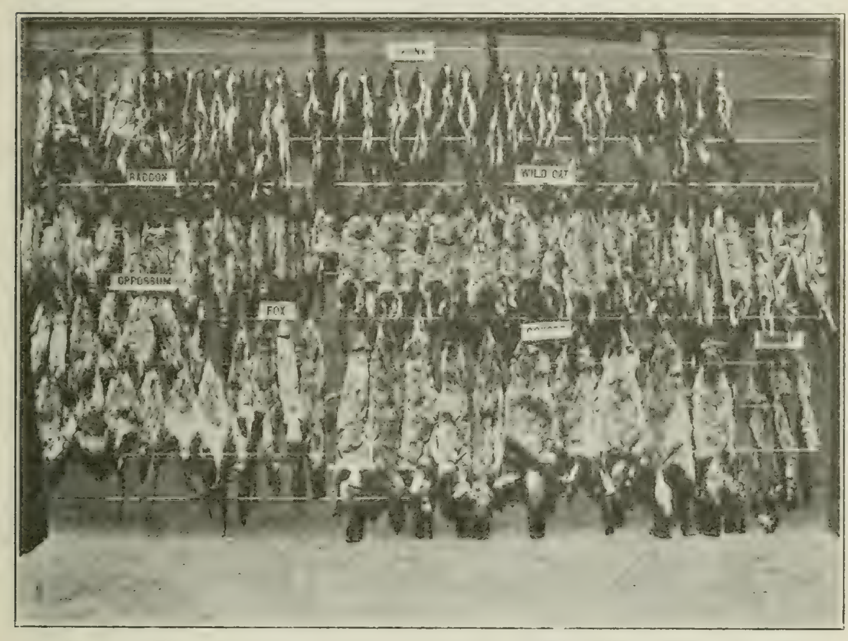

FIG. 28. Catch of fur-bearing mammals on the Spring Valley Water Company property in San Mateo County, season 1922–23. One hundred twenty pelts in all. Note the twenty opossum skins. Courtesy Spring Valley Water Company.

WATER COMPANY DESTROYS PREDATORY ANIMALS.

The Spring Valley Water Company has been doing systematic trapping on its properties in northern San Mateo County for several years past. This constitutes an interesting trial of the much vaunted value of the control of predatory animals as a means of increasing game, for no hunting is allowed on the properties and there should be an opportunity to determine what relations exist between the predatory animals and game.

Valley quail were once very numerous, and the trapping operations have been instituted largely as a means of increasing this game bird. That a real toll is annually being taken of the predatory species is evidenced by the accompanying photograph which shows the results of the 1922 season. In all, 120 animals were taken, as follows: coyotes, 10; cats, 24; coons, 16; foxes, 4; opossums, 20; skunks, 38; civet cats, 5; squirrels, 3.

Last year on an area of 10¼ square miles, 84 predatory animals were secured. Attention is called to the large number of opossums, which demonstrates the fact that this is now a common animal on the peninsula, although introduced into this state as recently as 1910.

A DEFENSE OF THE COYOTE.

In eastern Oregon, where the coyote has been hunted by federal officials for the past several years, the jackrabbit has grown so abundant that since 1911 it has taken at least 10 per cent of all the crops suited to its food habits. This applies, of course, to the sections along the stock growing belts where alfalfa is the chief forage crop.

In 1911, I began to take the matter up with the federal authorities, and was told that an epidemic would soon give us all the relief we could ask for. There were two slight "waves," when the rabbits were somewhat reduced in numbers, but they were back to normal within a year each time. Ground squirrels were nearly as numerous as the rabbits, but did not destroy as much because of the fact that they do not work all year.

As for the damage done by the coyote, I believe that it is not nearly as great as is claimed, and this seems also to be the opinion of some stockmen. The manager of one of the largest sheep outfits in the world has stated to the writer that the coyote is responsible for some 8 per cent of the losses among sheep. He also said that the greater part of this loss was sustained during May, the breeding season of the coyote, and that if the herders would take better care of their flocks, much of this loss could be avoided. I have several times found, in cases where heavy losses were being claimed, that the sheep were bedded down in an exposed situation, with the herders and the dogs sleeping a mile or more away from their charges. This gave the coyote ample opportunity to help himself.

The killing off of the rabbits by poisoning has been a total failure in the section where I took my notes, although it was tried several times. I am convinced that the best check is the coyote, which Nature has placed there to keep down just such pests. I hold no particular friendship for the coyote and am willing to admit that in some parts of the country it should be reduced or driven out; but in the above mentioned locality, as well as in other sections of the northwest where the rabbits and ground squirrels are the greater pest, I have no doubt that the coyote is the rancher's best friend and that many of them so regard it. Its killing is a double tax on the country and I do not understand why it is not looked upon in this way by the government.—A. W. Anthony, San Diego, California.

THE FUTURE OF ANGLING IN THE SAN JOAQUIN.

The power companies which are responsible for the great dams which keep fish from reaching their spawning grounds have in a measure compensated for the reduced run of fish by building roads which form the only means of access for anglers and have taken pains to stock newly completed reservoirs. The following letter from the managing director of the San Joaquin Light and Power Company is typical of the interest in fish conservation usually displayed by power company officials. The picture of conditions expected with further development is of particular interest to every angler.

FRESNO, CALIFORNIA, March 29, 1923.

MR. W. H. SHEBLEY,
c/o California Fish and Game Commission, Sacramento, California.

DEAR MR. SHEBLEY:

I have just read that part of your report of 1922, relating to the history of fish-cultural operations in California—especially that part of it on pages 94 and 95 that deals with the Merced and San Joaquin rivers.

I think you stated quite rightly the situation with reference to the Merced River, but I think you have overlooked in the San Joaquin River that the Miller & Lux and the Madera people are expecting to build a dam about half a mile above the station at Friant, that will be about 280 feet high. To impound the flood waters of the San Joaquin River will at times make the river entirely dry below the dam; that is to say, such seasons of the year as the water is not being used beneficially for irrigation, it will be impounded and the dam will back the water nearly up to the Kerckhoff Power House of the San Joaquin Light and Power corporation. After that is built, I do not think I am exaggerating in saying that there will be but a short period each year when any of the water from this stream will reach the bay; not only will the river be dry from Friant to the intake of the Miller & Lux ditches, above Firebaugh, but it will be dry from there to the mouth of the Merced, and when the Merced is reservoired, from there to the mouth of the Tuolumne River, and inasmuch as the Tuolumne is already reservoired at Don Pedro, it will dry the river from there to the mouth of the Stanislaus. As there are several big plans on foot for the storage of flood waters on the Stanislaus, it looks to me as though the only water that will be in the San Joaquin will be that amount that seeps in from the irrigation of the west side, through the spongy west bank of the river. So it looks to me as though any plan to perpetuate the streams referred to as breeding grounds for salmon are doomed, for the water must either be used for irrigation or the country will become as dry as the desert of Sahara.

These large reservoirs, however, will make it possible to develop wonderful fishing grounds for other kinds of fish. In our reservoir on the North Fork of the San Joaquin River, at Crane Valley, literally thousands of people are attracted by the fishing opportunities—just as they are at Huntington Lake, on Big Fork of the San Joaquin. While we shall probably have less salmon, we shall have more bass and trout, and I hope you will make it trout, as the bass are not a satisfactory fish with which to stock our big artificial lakes. People have gone up to Crane Valley with carp minnows for bait and the carp have gotten a start that supplies much of the necessary food for the bass: they are therefore not biting nearly as well as they did a few years ago.

Large reservoirs will also be built on Kings, Kern, Kaweah and Tule rivers, but none of these streams were ever noted as salmon streams; they will, however, make additional fishing grounds for other species of fish and will be a thousand times more beneficial to the people than the streams are at the present time, at the locations of these reservoirs. We may, therefore, lose our streams as salmon breeding grounds, but we will gain millions in population by the irrigation of what are now dry lands by the impounded waters, and their pleasure in fishing where there is an opportunity to fish, will, I think, have to compensate for the loss of the salmon.

Very truly yours,
A. G. WISHON,
Vice President and Managing Director.

RESOLUTIONS.

Among the more interesting resolutions adopted at the Ninth National Game Conference assembled at New York City, December 11 and 12, 1922, were the following:

"WHEREAS, the American Game Protective Association is a recognized national leader in game conservation; and

"WHEREAS, a number of game associations in the western states have requested advice and assistance from the American Game Protective Association in their work of game protection; be it

"*Resolved*, that a conference be called at some designated point in the western part of the United States under the auspices and direction of the American Game Protective Association for the purpose of discussing problems pertaining to the western section of the United States and the organization of state game associations throughout that country.

"*Resolved*, That the National Game Conference of the American Game Protective Association calls renewed attention to the dangers threatened by the constantly increasing pollution of our waters by turning chemicals, oils and other waste into our streams and by the discharge of oil waste from incoming ocean steamers. Wild life thereby is frequently destroyed or driven away and the public health is seriously endangered. Federal and state legislation should be promptly enacted and enforced to end this enormous abuse.

"*Resolved*, That the National Game Conference of the American Game Protective Association heartily endorses H. R. 12143 providing for the establishment of an Alaskan Game Commission to protect game, land fur-bearing animals and birds in Alaska, and for other purposes.

"*Resolved, further*, That a copy of this resolution be furnished the Secretary of Agriculture, the chairman of the Committee on the Territories in the House of Representatives and the author of the bill, the delegate from Alaska.

"*Resolved*, That the National Game Conference of the American Game Protective Association is in hearty sympathy with the movement to lessen the destruction of our fur-bearing mammals and advocates the establishment by all the states of long, annual, closed seasons on fur-bearers and the licensing of all trappers and of all dealers in raw furs.

"*Resolved*, That as the National Game Conference of the American Game Protective Association heartily approves of the regulations of the Migratory Game Treaty relating to the shipment of game by nonresident citizens, it strongly recommends to the various states to amend their laws to agree with the federal regulations so that visiting sportsmen may ship without difficulty legally killed birds."—Bulletin of the American Game Protective Association, Vol. 12, No. 2, April, 1923.

CANADA'S INTRODUCED PARTRIDGES.

Discussing the successful introduction of Hungarian partridges in the Province of Alberta, Canada, and Spokane County, Washington, a writer in *Fins, Feathers and Fur*, official bulletin of the Minnesota Game and Fish Department, says: "The following plan used by the Alberta Fish and Game Association of Calgary, Canada, should be closely followed in this state. Mr. Fred Green of Calgary, in a letter to Mr. Holland (vice president, American Game Protective Association), says: 'The results we have obtained are far beyond our fondest dreams. The birds have multiplied and spread out so that they are now found in all directions from Calgary. The first planting of 195 pairs has increased to such an extent that a full month's open shooting season is now permitted with a season bag limit of 50 birds. The successful method of planting Hungarians is as follows: Fifteen pairs were put down in a favorable locality and then a circle was drawn, the edge of which would be about four miles from where the first lot were put down. We then liberated five pairs every mile or so around this circle. Later we enlarged this policy and planted more to the north and south, knowing they would follow our streams which run east and west.'"

EARLY GAME CONDITIONS IN THE GREAT VALLEYS.

The passing of Lyman Belding, a pioneer of Stockton, and the appearance of his biography by A. K. Fisher (*The Auk*, Vol. XXXVII, pp. 33-45), has brought to light some interesting descriptions of game conditions in the early days. He settled in Stockton in 1856, and in describing conditions he says:

"Game was abundant, including elk, antelope, deer, bear, otter, quail, and waterfowl. Elk have disappeared from the interior valleys of the state excepting a drove on the Miller and Lux Ranch of forty thousand acres in the San Joaquin Valley, and these animals are being captured and distributed to various parks. The elk of this state inhabited the tule marshes mainly, though I have seen many elk horns in the Marysville Buttes, probably left there by elk which came from the marshes of Butte Creek, and I have seen hundreds, if not thousands, of elk horns on the border of the tule swamps north of Stockton. Antelope have entirely disappeared from the Sacramento and San Joaquin valleys. I saw three in the latter valley a few miles west of Princeton in the summer of 1870 and a single one in Lower California about twenty-five miles south of Tia Juana in the spring of 1887. Deer were mostly in the mountains, with a few along the rivers where there were extensive thickets on bottom lands. They will continue to be common with proper protection.

"Beaver and otter were plentiful in the sloughs and tule marsh about Stockton. Beaver built houses on the marshes as the musk-rats do on the marshes in the prairies of the Middle West. There were several of these beaver houses within three miles of Stockton. They were on land that floated, as much of the peat land does in the tule swamps about Stockton. I shot seven beaver in one day in the flood of 1861 and 1862. I would jar the houses and watch for the cautious appearance of the occupants as they came out to ascertain the cause of the disturbance. They would approach under water to within a few feet of me, just as I had often seen muskrats do when I was a boy, and the only evidence of their presence would be a little circular wave caused by their breathing, with only the tip of their noses even with the surface of the water. The beaver about Marysville burrowed in the banks of the rivers. Beaver and otter became scarce long ago.

"I went to Marysville to reside early in October, 1862. Small game was abundant. Myriads of ducks and geese came from the north and east of the Sierras in October and November. Butte Creek attracted most of them. The wood duck was very common on Feather River and was a constant resident. It is now, as in the country generally, quite rare. The mountain plover appeared abundantly on the plains in October. At present it is apparently on the verge of extinction. There were a few deer along Feather River below Marysville and a few in the Marysville Buttes. Mountain quail came down from the mountains near Oroville and other localities on the eastern border of the valley to spend the winter."

DEER DIE IN HUMBOLDT COUNTY.

The finding of a large number of dead deer in Humboldt County has led to wide discussion as to the cause of death. Newspaper items appearing in various papers of the county have attributed death to widely different causes. Some have maintained that death was due to a lung worm, some to hemorrhagic septicemia, and still others to "scours," a form of diarrhea. It seems doubtful whether there is sufficient evidence to point out any one of these causes as the one responsible. Unless post-mortems could be made by some capable scientist familiar with diagnosis, it seems doubtful whether the matter can be definitely settled.

SHARK MEAT SOLD AS "WHITE BASS."

It is understood that considerable quantities of shark meat, said to be mostly the flesh of the cat or leopard shark, *Triakis semifasciatum*, are being sold in the San Francisco markets under the name of "White Bass." While shark meat is wholesome and quite palatable when properly prepared, it is regrettable that it is not sold under its own name. Such practices may appear to offer an immediate and unusual profit, but ultimately inure to the injury of the fish trade. The exploitation of this meat is desirable, but it should be done without misrepresentation and at a reasonable price. The prevailing price in San Francisco is said to be 15 cents per pound. Successful experiments in salting and smoking shark meat have been conducted on the Atlantic coast.—Fisheries Service Bulletin, No. 94; March 1, 1923.

GROWING ACTIVITY OF CALIFORNIA FISHERMEN ALONG MEXICAN COAST.

In Bureau of Fisheries, Document No. 939, Mr. R. A. Coleman, an agent of the Bureau, gives many facts of interest concerning the fishing operations of California boats in Mexican waters.

Since no natural boundary mark exists between the United States and Mexico, from the earliest times of which we have records that California fishermen have ignored the line and gone south for their catch. Practically all of the fish taken in southern California waters can be found off the Lower California coast in greater abundance than farther north. Apparently the fish migrate to the warmer southern waters as the season advances, and in many cases can be taken during the entire winter season.

Very favorable conditions for fish life exist along the coast of Lower California with its continuous "fishing shelf," with water less than one hundred fathoms deep and with its shoreline deeply indented by many small bays and lagoons.

"The yellowfin tuna, the bluefin, the so-called halibut, the barracuda, the white sea bass, the black sea bass, the yellowtail, the mackerel and others are found in greater abundance south of the line than off the California coast, and all these fish spawn in these southern waters. The albacore is the only one of these groups that has not been taken south of Cedros Island.

"What has been said of the abundance of fishes is also true of crawfish, turtles and abalones. The turtle is rarely taken north of the boundary line, and the others are so nearly fished out in the waters of the United States that the catch is small."

Eighty-five per cent of the sea crawfish or spiny lobster coming into southern California is brought from Mexican waters. The amount annually imported is estimated at about 4,000,000 pounds.

Practically all of the turtles (*Chelonia agassizii*), are brought to California alive from Mexico. They are at present captured alive at San Bartolome and Magdalena Bay, but the Gulf of California will be in future the chief source of supply. Fully 5000 turtles are imported annually. A turtle cannery in San Diego Bay has two vessels bringing in turtles, and the canning of soups and steaks is increasing.

The supply of abalone in California waters being practically exhausted, the take is now confined almost entirely to the Lower California coast. A Japanese firm of San Diego controls this business in the south and has camps of from five to ten men who move from place to place getting the abalone. The product amounts to from eighty to one hundred tons of dried meats per year, valued at about $700 per ton. Before the war abalone shells were in much demand in England and on the continent, and the trade is now reviving somewhat. At present the imports amount to from twenty to twenty-five tons only per year valued at $60 to $120 per ton. "Blister pearls" of considerable value are occasionally found.

As early as 1888 J. W. Collins in a report to the Commissioner of Fisheries, U. S. Commission of Fish and Fisheries, speaking of the fishing in San Diego County, mentions that fishermen go from 200 to 300 miles along the southern coast for bonito and barracuda, but it was not until about 1908 that the amount taken was of commercial importance. At first the fishermen were not interfered with by the Mexican government, but later patrol boats were put on, and at present there are Mexican agents in San Diego and San Pedro from whom fishing permits must be obtained and to whom catches must be reported.

In 1920 from sixty to sixty-five power boats operated in these southern waters, but during the tuna season only about half that number go south. This number is likely to be largely increased in the future.

"In 1918 the average take of fish in Mexican waters by California fishermen was 700,000 pounds per month, on which export duty of $3,500 was paid, boat charges, clearance, etc., being additional."

"It was estimated in 1920 that of the important food fishes brought into southern California the following proportions were taken in Mexican waters, the balance being secured north of the line.

	Per cent
Halibut (so-called)	80–90
Barracuda	75
Sea bass, white	60
Rockfishes	10

"Boats coming from Mexican waters frequently bring huge cargoes. In 1918 the Veribus Unitas entered San Diego harbor with 46 tons of fresh fish. Another boat brought in a 31 ton catch of barracuda and bonito."

UNITED STATES LEADS IN GAME REFUGES.

In commenting upon bird sanctuaries, the Spring Number 1923, of *Bird Notes and News*, a British publication, urges increased effort toward the establishment of national bird sanctuaries and wild-life reservations in order to prevent the reckless depletion of both birds and other fauna. In the establishment of national wild-life reservations the writer says that the United States and Canada have been leaders, and that Africa, Australia, New Zealand and India have made beginnings. Holland, thanks to the efforts of a number of eminent enthusiasts, has many fine bird sanctuaries, and in this respect is ahead of all Europe. Bohemia is taking steps toward the establishment of several national refuges, particularly for waterfowl. In Great Britain, although there are a few private and municipal sanctuaries, there are no national wild-life sanctuaries. Present laws make it possible to forbid killing birds and taking eggs in certain localities, but since there is no provision made for guardianship of any kind, it is difficult to enforce such a prohibiting order. It is a hopeful sign that the subject is to be discussed at the International Conference which meets in Paris this summer.

CONDITIONS IN REFUGE 1D.

On April 30, a trip was made to the salt grounds within Game Refuge 1D in the Trinity National Forest. At an altitude of 8000 feet and in the timber on the north side of the mountain, snow was five feet deep, but there was no snow at all on the south slopes. The deer had already arrived and were gathering around the salt grounds waiting for their rations. Last fall, 200 pounds of salt were packed in and stored in the Lookout Station, so a supply was available. The deer proved to be very tame—they would just move out of the way and stand.

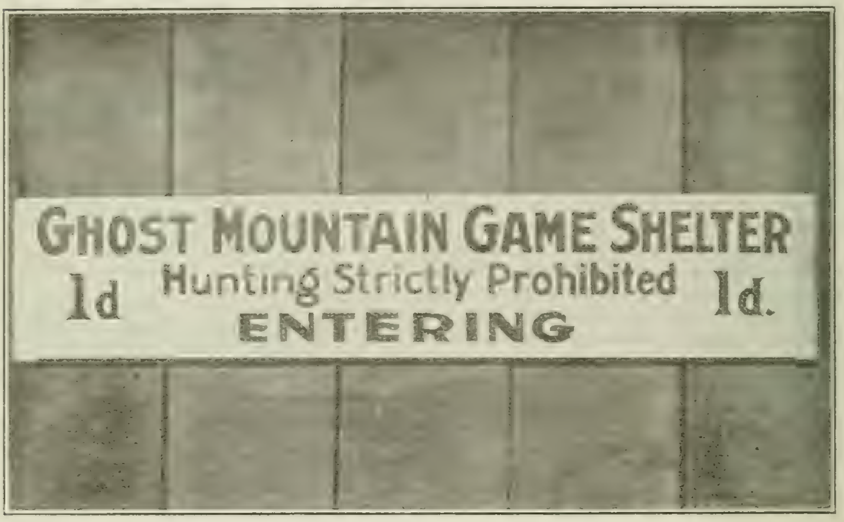

FIG. 29. New signs for the Trinity County Game Refuge.
Photograph by G. O. Laws.

Several deer died last winter in Trinity County but I do not believe death was due to any contagious disease. All that I examined were very poor and were covered with ticks and lice. There was nothing in the stomachs or lungs of those examined to correspond with the malady of several years ago.

Quail were found about half way up the mountain, apparently following the feed.

The general outlook for hunting and fishing for 1923 is very good. The Forest Service has built many new trails and wagon roads, and with the expected completion this fall of the Hyampon-Hayfork road, Trinity County's hunting grounds will be open to auto travel. New signs using the old Indian name of Ghost Mountain have been conspicuously placed along the road from Hayfork to Hyampon. Each year finds the refuge more highly appreciated by the residents of Trinity County.—**G. O. Laws, Douglas** City, California.

PELAGIC SEALING PROHIBITED.

On April 9th, President Harding issued an executive order designed to protect from unlawful pelagic sealing, the herds of fur seals that annually migrate through Alaskan waters to the Pribilof Islands. This was done in pursuance of an act of Congress concluded in July, 1911, "to give effect to the convention between the governments of the United States, Great Britain, Japan, and Russia, for the preservation and protection of the fur seals and sea otters which frequent the waters of the North Pacific Ocean." Patrol of the waters by six boats of the Bureau of Fisheries is ordered and the masters of the vessels, together with a few other designated employees of the Bureau, are empowered to search any vessels of the United States suspected of violating the laws, and to seize and bring into port for trial, the officers and crews with the vessels. Fisheries Service Bulletin No. 96, further reports that in the

12 days following the promulgation of the order, about 25 illegally taken skins were seized by three of the boats engaged on the patrol.

THE MIGRATION OF DUCKS.

There has been much speculation as to the breeding grounds of ducks wintering on Lake Merritt, Oakland, and in the great valleys of California. The practice of banding and releasing migratory birds, which is being carried on by numerous ornithologists and bird enthusiasts under the direction and supervision of the U. S. Department of Agriculture, is helping to solve the problems of where the birds go when they leave their nesting grounds and what routes they take. It is indeed the only means of getting certain and definite data regarding individuals or groups and the routes taken by them. There has been much more activity in bird banding in the eastern states than in the west, but Mr. J. Eugene Law, in charge of organization on the Pacific Coast, is authority for the statement that more than forty permits have been issued to banders on the Pacific slope.

In Bulletin No. 1145, of the U. S. Department of Agriculture, issued in May, 1923, Alexander Wetmore, of the Bureau of Biological Survey, gives the records of many birds banded in the Bear River marshes of the Great Salt Lake, Utah, where large numbers of migratory birds congregate. Mr. Wetmore was studying alkali poisoning among the birds of those marshes from 1914 to 1916, and during that period 1241 birds of 23 different species were banded. The majority of these were wild ducks comprising 9 different species. With the exception of a few birds turned over to the State Fish and Game Commission in 1916 for exhibition purposes and later released near Geneva, Utah, all of the birds banded were released near the mouth of the Bear River, Utah. Of this number, returns were received on 182 birds, a little over 14 per cent. Of the 994 ducks banded, 174 were retaken, giving a return of 17 per cent on the birds of this family. It should be stated that many of these birds had not bred in the vicinity as drake pintails and mallards begin to arrive there early in June and continue to come until late in the fall.

Distinct migration routes were traceable, one of which was southwest from the Salt Lake Valley to California, traveled by the green-winged teal and shoveler and some of the mallards and pintails. One group, made up of cinnamon teal, redhead, pintail and mallard, find their way into Texas by two different flight routes. The third route is a general drift southward over the Rocky Mountain Plateau to the scattering ponds and lakes of southern Utah, New Mexico and Arizona. Indications are that this route is followed by a smaller number of birds, including the snowy herons as well as some of the ducks.

The following tabulation indicates the species upon which returns were received and shows the number of each reported upon:

	Banded	Returned
Double-crested cormorant	1	1
Mallard	72	22
Gadwall	17	4
Green-winged teal	336	49
Cinnamon teal	45	5
Shoveler, or spoonbill	48	9
Pintail	221	34
Redhead	239	51
White-faced glossy ibis	104	1
Great blue heron	11	4
Snowy heron	83	4
American coot	18	1

Of the comparatively small number of mallards banded, about 30 per cent were afterward reported. One of these, banded September 24, 1914, was recovered October 16, 1916, nine miles south of Bishop, California. None of the gadwalls were traced to California, but of the 49 green-winged teal recovered out of the 336 banded, 19 were taken in California over a range extending from Yolo County to Orange County. None were taken north of Sacramento, two in Kern County, several near Los Banos, while on the coast two were taken in Orange County and one at Watsonville. As most of the others were killed near the place where they were banded, the conclusion was drawn that most of the green-winged teal which leave Utah winter in California. No cinnamon teal were recovered in California but one shoveler or "spoonbill" was taken near Vallejo, October 28, 1917, having been banded September 1, 1916. Since six of the nine banded were retaken in the same vicinity within a very few weeks, and two at other points in Utah, there is slight evidence that some shovelers come from Utah to California to spend the winter.

It is apparent that many pintails migrate to the interior valleys of California, for eight returns were made from an area extending from the marshes above Suisun Bay to a point south of Calipatria in the Imperial Valley. Boundaries of the various migration routes followed by the pintails recovered are indicated as being east as far as western Missouri and north as far as southern Saskatchewan, Canada. One of the pintails banded lived four years after being released. None of the large number of redheads banded were retaken in California.

Among other interesting facts gained from the study was that out of 104 young white-faced glossy ibises banded in their rookeries only one individual was recovered. As this bird was marked July 3, 1916, and was found October 22, 1922, on the shores of Tulare Lake, a southwest migration movement from the Salt Lake Valley to California would seem to be indicated. The nests of snowy heron are found in colonies in the lower Bear River marshes where, on July 3 and 14, 1916, 83 nestlings were banded. Three of the four recovered were found in Mexico, the fourth in Arizona, upon dates that would indicate that these herons from the breeding grounds of Utah winter on the west coast of Mexico.

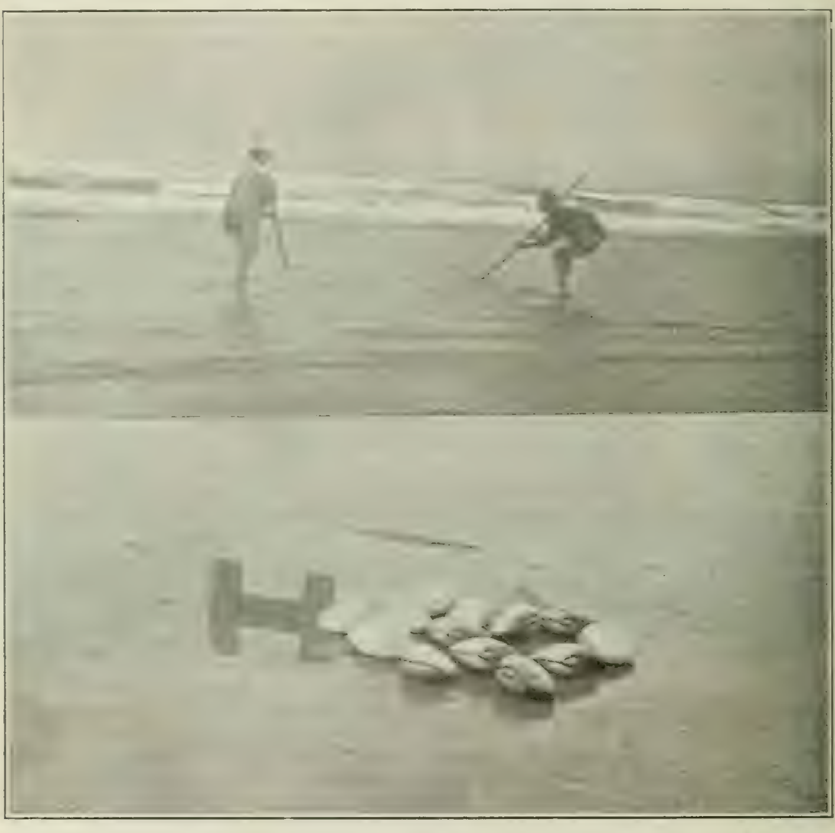

FIG. 30. Digging Pismo clams near Watsonville, California, April, 1923. Photograph by J. H. Hill.

There are many other problems aside from migration routes, length of flights, ages of birds and so forth to be solved by bird banding, such as differences in plumage at various ages and at various seasons; whether the birds return to the same nesting sites; rate of growth; and diseases affecting different species as discovered by those cooperating in this work under the Biological Survey. As the practice becomes extended it is anticipated that much valuable data concerning western birds will be collected in this way, as has already been done in the east.

SCIENTIFIC WORK OF THE COMMISSION APPRECIATED.

That the valuable studies of California fishes prosecuted under the administration of Mr. N. B. Scofield, in charge of the Commercial Fisheries Department, are of the very highest order and an accomplishment which promises soon to place California ahead of other states in respect to the care of her fisheries, is pointed out by Mr. Willis H. Rich, in charge, Division of Scientific Inquiry, U. S. Bureau of

Fisheries, writing in the *Stanford Illustrated Review*, for May, 1923 (p. 406). Mr. Rich also expresses anxiety lest the scientific work of the commission, pursued by Mr. Scofield's division and under the supervision of Mr. Thompson, should be discontinued for lack of funds. This, according to the writer, would be a calamity, not only to the scientific development of California fisheries, but also to the country at large.

LOUISIANA'S SUPERLATIVES.

In *Conservation News*, the bulletin of the Louisiana Department of Conservation, April, 1923, attention is called to the resources which Louisiana possesses in superlative degree. Pertaining to fish and game are the following interesting facts. In 1922 the value of the state's sea food products totaled about nine million dollars. The annual yield of the fur products of that state ranges between two and three million dollars. Louisiana is the possessor of the greatest public shooting ground in the world as well as the largest areas in the world where waterfowl and other forms of wild life are completely protected. No other state has an area suited to oyster culture as great as that of Louisiana—477,000 acres.

That these things are true is largely due to a broad-visioned, wisely-planned conservation policy to which sympathetic public support has been given. Back of it all lies education and publicity of the right kind.

NUMBER OF HUNTERS INCREASING IN UNITED STATES. HOW ABOUT THE GAME SUPPLY?

It is estimated that there are in the neighborhood of 8,000,000 hunters in the United States. During 1921–22, the number of persons in 46 states who purchased hunting or fishing licenses, or both, ran close to the 5,000,000 mark. Two states, Mississippi and North Carolina, had no fish and game commissions, (North Carolina has since organized one); in Delaware residents are not required to purchase a license; in Texas it is unnecessary to have a license for the county in which one resides; and in Florida reports are very incomplete because county judges are not required to make reports on license sales. According to the Department of Agriculture nearly 3,000,000 hunters are, for just such reasons, exempt from taking out a license. The National Sports Syndicate has for five years been gathering statistics regarding hunting and hunters and during that time they have found that the number of licensed hunters has increased at the rate of never less than 50,000 a year. It would be valuable to know whether the supply of game is being maintained in spite of this rapid increase of hunters, or is diminishing, or whether, possibly, due to game protection and propagation, regulation of the hunting season, law enforcement and other measures, game is increasing. Mr. Peter P. Carney of the syndicate suggests that it would be to the best interests of all concerned if every state fish and game commission would keep a record and send out figures on the number of licenses issued, the amount paid for them, the amount of game taken and, as nearly as can be determined, the amount of game remaining.

TREES AND BIRDS.

It has been shown time and time again that increased planting of trees furnishes attractive food, nesting sites and shelter for birds. Oftentimes the planting of trees has not kept pace with the destruction of trees. It is gratifying, therefore, to see the enthusiastic support given the plan to beautify the state's wonderful system of highways by tree planting. There are many sections in the great valleys where not a tree exists for many miles. Many a lonely country roadside will in the future be made more cheerful by the presence of a line of beautiful trees which give shelter to hundreds of song birds, due to the foresight of those promoting the planting of trees along the highways, in school grounds and parks, and in private gardens.

CHANGES IN FEDERAL GAME LAWS.

Amendments to the Migratory Bird Treaty Act Regulations, adopted by the Secretary of Agriculture and approved by the President on June 11, include a change in the season for hunting migratory waterfowl in Pennsylvania from September 16–December 31 to October 1–January 15, and in Oklahoma and that part of Texas lying north and west of the International and Great Northern and the Texas and Pacific Railroads from October 16–January 31 to October 1–January 15, while the season in southeastern Texas was changed from October 16–January 31 to November 1–January 31.

The open season for hunting doves in southeastern Texas was changed from September 1–December 15 to November 1–December 31, and in South Carolina from September 1–December 15 to November 1–January 31.

These changes were adopted at the solicitation of state game officials and interested sportsmen in the sections affected, and are believed to be in the interest of conservation.

Other amendments authorize the issuance of permits for propagating waterfowl and for scientific collecting purposes to be valid until revoked by the Secretary of Agriculture, thus obviating the necessity of renewing such permits from year to year to cover continuing operations. The latter amendments are designed to facilitate the administration of the law and regulations. Annual reports from permit holders will be required as heretofore.

TAKING BIRD CENSUSES.

A new government publication, Department Circular 261, The Purpose of Bird Censuses and How to Take Them, by May Thacher Cooke, assistant in biological investigations, has been issued by the United States Department of Agriculture, and is available on application to the Biological Survey or the Division of Publications, United States Department of Agriculture, Washington, D. C.

This publication is designed for persons now cooperating in taking bird censuses, also for ornithologists and others desiring information on the subject. In addition to an explanation as to the need of data regarding the numerical distribution of the various species of birds in different sections of the country, the circular gives instructions on how to make local counts, the time to begin, and the types of tracts from which censuses are desired. These include farm land, wood land, irrigation projects, marsh land, and other special areas.

Directions are given for rendering a report of each census when taken. Blanks for these records are furnished by the Bureau of Biological Survey.

ENCOURAGING CONDITIONS PREVAIL IN ALASKA IN 1922.

A spirit of public cooperation in respect to the conservation of wild life in Alaska is more widely marked than ever before, says Governor Scott C. Bone in his second annual report to the Secretary of Agriculture on the Alaska Game Law. Respect for the law is the rule, and the schools of the territory are cooperating by the use of a questionnaire on animals and birds.

Conditions touching animal and bird life in Alaska have been very favorable during the past year in the opinion of the governor. Game is said to be plentiful, and animal life of all varieties seems to be increasing.

Sentiment continues to favor removing the protection afforded the brown bear, which is a dangerous predatory animal. At Afognak last year three hunters met four ferocious bald-faced Kodiak bears and one of the hunters was killed. There are few black bears on the Alaska Peninsula, though they are plentiful and increasing in the Kantishna, Fairbanks, McCarthy, and Ketchikan sections.

Ptarmigan and grouse have shown gains, and geese and ducks are reported in numbers in the region of Lake Minchumina, according to the governor's report. Many fur-bearing animals are increasing, including a variety known as the tundra mink. Arctic hares are reappearing by thousands, as well as rabbits, and are doing considerable damage to planted areas. The depredations on fur bearers and game animals by wolves, wolverines, eagles, hawks, and coyotes, which also are increasing, seem to warrant stringent measures for their control. Fox farming on the islands of southeastern Alaska is proving profitable and popular.

One thousand dollars was paid to the territory for hunting licenses during the fiscal year ending June 30, 1922, and in addition, $300 was paid for special moose-shipping licenses and $290 for other licenses.

FACTS OF CURRENT INTEREST.

In March last, the collapsing of a municipal dock at Monterey precipitated forty cases of canned sardines into Monterey Bay. Most of the cases were salvaged after efficient work by the members of the fishing fleet.

* * *

Fishermen in Suisun and San Pablo bays who persist in setting nets or using illegal nets are gaining experience at high cost, for fines averaging $100 are regularly meted out.

* * *

The trout season opened auspiciously on May 1. Fishing has been remarkably good, due largely to the series of good years with a maximum of water and to the restocking operations of the Fish and Game Commission.

* * *

Educational work in the summer resorts is being continued in Yosemite National Park this year. Increasing interest in this educational program is very evident.

* * *

Striped bass anglers who sought legal protection for their night fishing activities will have to accommodate themselves to a new law with the same provisions in order to make law enforcement possible in connection with commercial fishing.

* * *

As evidence of the important part played by the automobile in increasing the toll of game taken, it may be pointed out that Deputy J. O. Miller counted forty-seven machines on the edge of the lava beds on the opening day of the deer season of 1922. All of these machines carried hunters interested in securing a mule deer.

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HATCHERY NOTES.

W. H. SHEBLEY, Editor.

THE SPAWNING SEASON.

Splendid success has attended the special efforts of the fishcultural department to obtain a large take of trout eggs for the hatcheries. The eggs taken have passed the 29,000,000 mark which means that this year's supply has exceeded that of last year by over 4,000,000. With the exception of floods at Lake Tahoe which washed out racks and interfered with operations for black-spotted trout, conditions have been very favorable. The Snow Mountain Spawning Station furnished an unusually large number of steelhead eggs. On the other hand, the take on the Klamath was 50 per cent below normal. The Feather River Hatchery, now practically completed, is operating with a capacity of 850,000 eggs. The Kaweah Hatchery contains 400,000 and the Wawona Hatchery has a like number. Spawning operations were still in progress on June 1st at the spawning stations in Plumas and Lassen counties. Operations at Rae Lakes have been postponed owing to the impossibility of crossing the high mountain passes.

BREEDING PONDS YIELD LARGE NUMBER OF EGGS.

A dependable supply of trout eggs is always available from the brood ponds at the Mount Shasta Hatchery. Nearly one-third of all of the trout eggs utilized in the state hatcheries are derived from brood fish. The season 1923 furnished 2,760,000 eastern brook, 5,270,000 Loch Leven and 1,500,000 brown trout, making a total of 9,530,000 eggs.

EASTERN BROOK TROUT EGGS IMPORTED.

An exchange of 1,000,000 Loch Leven trout eggs for an equal number of eastern brook eggs with the New Jersey Fish and Game Commission will furnish an added supply of pure eastern stock to the streams of the state. In the east, the Loch Leven is in great demand as it is thriving much better than other species in eastern streams where sewage disposal pollutes practically every stream. This species, along with the brown trout, seems to be especially resistant to disease. The rainbow has been found impractical under most conditions in eastern states.

MACKINAW TROUT SECURED.

For the first time in many years it has been possible to secure eggs of the Great Lakes trout, the species commonly called Mackinaw. One hundred thousand fry now thriving at the Mount Shasta Hatchery were planted in late June in Clear Lake, Lake County, and in Eagle Lake, Lassen County.

This species was introduced in California in 1894 when 93 per cent of a shipment of 100,000 eggs were hatched at the Sisson Hatchery. In May of the following year, 65,000 of these fry were planted in Lake Tahoe, the remainder being held for shipment the next season. At other times, lots of eggs were hatched at Sisson and the fry planted in the various lakes of the Truckee Basin. Coming from the lakes Superior, Huron and Michigan, these trout are adapted to the cold, clear waters of deep lakes and should grow to a large size in Lake Tahoe. They have not, however, thrived as have other introduced species. Many years ago some young were taken in Fallen Leaf Lake during spawning operations, but apparently spawning grounds are not suitable.

STEELHEAD AND RAINBOW TAKEN IN TAHOE.

Steelhead and rainbow trout introduced into Lake Tahoe two years ago appear to be thriving, for several weighing up to 1½ pounds were taken during spawning operations this spring.

BROWN TROUT TO BE PLANTED IN RUSSIAN RIVER.

The steelhead run in the Russian River is largely a thing of the past. The bar at the mouth of the river, which has precluded the entrance of fish, has been one important factor concerned. In order to furnish angling for the many vacationists who line its banks each summer, brown trout are to be introduced this year. This species should prove the best adapted for this stream. Rainbow are also to be planted but they will doubtless inhabit the higher reaches of the river. The brown trout thrives in the slower moving, warmer waters.

MANY SCREENS INSTALLED.

During six weeks in late spring, seven large rotary screens were installed in irrigation canals. Most of these were built in Sacramento.

CONSERVATION IN OTHER STATES.

ARIZONA SOCIETY INTERESTED IN PRESERVING HEATH HEN.

The Tucson Natural History Society, through its conservation chairman, Mr. Hugh G. Calkins, has expressed to the Director of the Massachusetts State Department of Conservation, the hope that a thorough investigation may be made to determine the cause of the reduction in numbers of the heath hen on the Island of Martha's Vineyard and to find, if possible, some means of successfully maintaining the species. Formerly abundant, there now remains of the heath hen a flock of only 150 individuals on the island. We agree with the Tucson society that thoughtful people everywhere, who are lovers of nature, will be interested in an effort to preserve the existence of this, or any other valuable or interesting species, wherever they may be, whose continued existence is threatened.

MICHIGAN AND THE BOUNTY SYSTEM.

Much has been written pro and con on the bounty system of controlling predatory animals. Recently, the State of Pennsylvania defended the system. The State of Michigan takes the opposite point of view and recommends the abolition of the system. In 1919 this state paid $124,446 in bounties on wolves. In 1922 the sum amounted to $36,043.50. The state comptroller states: "Personally, I do not believe that this bounty is a benefit to the state, and, doubtless, fraud is practiced. As the state has been paying bounty on wolves for twenty-five years and, instead of the number growing less, they seem to be increasing."

Furthermore, the expense of the bounty system has grown from $232 in 1870 to $371,236.44 paid in nine months of 1922. The sum of $1,100,000 has been paid in bounty claims since 1869. Numerous instances of fraud are said to show that, in spite of precaution, fraud can not be eliminated.

Although the government pointed out many years ago that bounty systems had proved expensive, ineffective and invariably conducive to fraud, yet many states still continue to spend vast sums on a bounty system.

NORTH CAROLINA VOTES DOWN NEW GAME BILL.

North Carolina and Florida are the only states without state-wide game laws. For the past twelve years repeated attempts have been made by conservationists to place North Carolina in line with surrounding states, but to no avail. Last December, the North Carolina Fish and Game Development League was organized to support a measure introduced in the legislature. When the game bill providing for protection of wild fowl and fur-bearing animals came to the floor, a dozen counties sought exemption and, in short order, the bill was laid on the table by a vote of 52 to 42. Thus was disposition made of the most recent attempt to establish an intelligent system of state enforcement of the bird and game laws.

TEXAS INTRODUCES BOB-WHITE.

According to the 1922 report of the Game, Fish and Oyster Commission of Texas, 1200 bob-white have been introduced into that state and favorable reports are being received continually.

A census of the antelope still remaining in Texas shows that there are about 547 individuals, all of which have taken to rough country where they are least molested. The very few mountain sheep which are left within the state are receiving adequate protection only where cattlemen who own the range take measures to keep out the poacher.

NEW MEXICO'S NEW GAME CODE.

In Mexico's new game code, enacted by the fifth legislative assembly, are numerous additions and amendments of outstanding interest. The alien gun law is a stringent one, making it "unlawful for any unnaturalized, foreign-born resident of New Mexico or of adjoining states, to use or have in possession, or under control within the state, any shotgun or rifle of any kind." A residence of five consecutive days in that or any adjoining state, causes any unnaturalized, foreign-born person to be considered a resident, and therefore liable to the penalties provided for violating any provision of the act. Night hunting, the use of high-powered rifles in the taking of migratory game birds, the killing of game with steel or hard pointed bullets or with any weapon other than ordinary shoulder guns or pistols is prohibited.

Certain plenary powers are given the commission which makes it possible to apply conservation measures promptly and avoids the necessity of waiting for legislative enactment as must be done in California. Among these are authority to receive gifts or bequests of lands suitable for use as game refuges, hunting grounds, fish hatcheries or for other purposes in accord with the act; power to close hunting at all times or at certain times on designated areas in order to provide havens where migratory birds may rest and feed unmolested; permission is also given to close any public waters to fishing, for the purpose of protecting spawning grounds or recent plantings of fish, or to prevent the depletion of the supply of fish; to aid in reducing the danger of destructive forest fires, the commission is given authority to forbid hunting entirely at such places and times as extreme danger of forest fires exists.

MICHIGAN INSTITUTES CAMPAIGN OF EDUCATION.

In its last biennial report, the Department of Conservation of the State of Michigan outlines an intensive campaign of education and publicity conducted during the past two years. Activities have been confined to the display of motion pictures and stereopticon slides, lectures on nature subjects and conservation, and issuing of booklets, pamphlets and posters covering activities having to do with natural resources. Ten 1000-foot reels of motion pictures are in almost constant use. A large number of very attractive posters have been distributed throughout the hunting regions and many booklets have been issued. Elementary works covering the flora and fauna of the state are planned for the use of school children.

IDAHO REORGANIZES FISH AND GAME DEPARTMENT.

Governor C. C. Moore of Idaho has appointed Mr. R. E. Thomas, who for the past four years has been Assistant Chief Deputy Warden, as State Fish and Game Warden to succeed Mr. Otto M. Jones, resigned. Mr. Thomas is said to have an intimate knowledge of the work, and, added to that, a knowledge of the conditions confronting the farmers and stockmen, so that harmony is expected to exist between those who hunt and fish and those interested in ranching. The *Mountain Home* (Idaho) *Republican* quotes Mr. Thomas as saying: "We have reduced the number of field men about 25 to 30 per cent and it is now our aim to cut this force down to around 30 and put the money thus saved into propagating and preserving our fish and game resources. This means that local wardens will be cut out in some instances and no new wardens will be added. Our force will be so distributed that the state will be covered most efficiently and, with the cooperation of the people in helping us to cut down our number of employees, we will be able to have more funds for building up our resources.

LIFE HISTORY NOTES.

OSPREYS IN MODOC COUNTY, CALIFORNIA.

On May 20, 1922, in company with U. S. Game Warden R. C. Steele, the writer made an auto trip between Malin, Oregon, and Clear Lake Reservation, California. This country is rolling, rocky, arid desert land, sparsely covered with a growth of juniper and sagebrush.

During the trip, four nests of the osprey (*Pandion haliaetus carolinensis*) were noted in juniper trees ranging approximately from 25 to 35 feet in height. Three of these nests were examined and two of them contained three eggs each, while one other was about completed and ready for its compliment of eggs. The fourth nest was not examined, except from the ground. One nest containing three eggs also contained a sucker about twelve inches in length, which had evidently been brought from Clear Lake, about eight miles distant.

None of these nests was closer than about five miles from open water. Three of the nests were saddled in the forks of stout limbs, while the fourth nest was built on the very topmost branches of the juniper about twenty-five feet high. The upper limbs of this tree were dead and the nest could be seen from a long distance. At all four nests, both parent birds were present and at two nests the parent birds were assisted in their demonstrations by their neighbor ospreys.—STANLEY G. JEWETT, 515 P. O. Bldg., Portland, Oregon.

REMARKABLE FLIGHT OF HAWKS.

On April 17, 1923, a very rainy day in El Dorado County, my attention was called to a flight of hawks, believed to be Swainson hawks (*Buteo swainsoni*), passing over my place on Lotus Road, near Placerville. The flight continued for a half hour and by 2. p.m. the main part of the flight was over. At least a thousand birds were included in this migration. My brother, who also witnessed the flight, left for Placerville while it was in progress and stated that a much larger number passed over "Thompson Hill," a range of hills to the east. The stomachs of specimens taken were examined by Dr. H. C. Bryant and found filled with black crickets (*Gryllus* sp.). If the entire flock had fed upon the insects, as it is reasonable to suspect, the birds undoubtedly rendered a valuable service to the locality from which the crickets were collected. It would be interesting to know how far the hawks had traveled and when and where they had secured the crickets.—GEORGE WILLIAMSON, JR., Placerville, Cal.

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF JANUARY, FEBRUARY AND MARCH, 1923.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Glenn, Colusa, Tehama	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego
Albacore												1,061			1,061		
Anchovies										5,300		10,537			15,837		
Barracuda											150	74,755	904	105,363	181,172	785,232	172,008
Bluefish										3,960					3,960		
Boccaccio								24,555	92,821	311,220	4,937				433,533		
Bonito										3,325		25,269		2,850	31,444	38,489	16,812
Carp		12,185		1,894		7,367	13,800	76							35,322		
Catfish		34,283				3,497									37,780		
Chilipepper								15,448	66,990						82,438		
Cultus Cod	2,398							95,047	7,012	31,720				2,728	138,935		31
Dolphin																	
Eels														55	55		
Flounders	13,719		12	49			5,146	150,099	14,972	1,280		27		172	185,476		110
Grayfish								70,695				1,827		50,580	123,102		
Greenfish																	
Hake								1,290							1,290		
Halibut								2,966	627	762	74,680	347,225	28,750	80,130	535,140	170	158,604
Hardhead						5,608									5,608		
Herring	2,501		24,435				65,637	175,052	158						267,783		
Kingfish									33,682	11,725		76,733		2,274	124,414	122	135
Mackerel									10	74,796	2,467	466,976	30,932	71,385	646,566	30,311	2,940
Marlin																	
Mullet												503		6,654	7,157	9,882	14,928
Perch	25,063		16,849	108			19	11,388	171	13,505	404	37,500	47	729	105,783	22,114	1,165
Pike				107		432	1,575	6							2,120		
Pompano								562		14		1,807			2,383	5,456	1,912
Rock Bass												35,846	1,732	6,801	44,379	8,054	3,248
Rockfish	150							168,072	118,187	375,813	27,865	627,056	21,782	226,592	1,565,517	515	8,534
Sablefish								47,901	11,008						58,909		
Salmon	281		2,422	26,214	42,160	18,300	22,242	285,123							396,742		
Sandabs								327,958		80		3,312	5		331,355		
Sardines								3,880	175	18,560,635	1,060	52,741,012		3,664,531	74,971,293		
Sculpin												13,212		2,635	15,847		
Sea Bass—Black												5,974		11,647	17,621	4,234	75,989
Sea Bass—White								17	247	18	29	32,628	1,012	52,750	86,701	92,914	16,600
Sea Trout														481	481		21,450
Shad				1,028		4,424	26,382	3,889	49						35,772		
Shad—Buck				3,799		1,484	23,604								28,887		
Shad—Roe				5,645		972	30,023	5							36,645		

Sheepshead											65	1,859	34	19,531	21,489		75
Skates								51,271		665		2,002	188		54,126		
Skipjack																	2,270
Smelt	4,131		7,281					37,470	616	551	33,739	98,939	2,536	6,163	191,426	1,075	870
Sole	50							1,796,998	8,393	9,705	21,827	71,237	920	5,565	1,914,695	95	209
Splittail						13,100									13,100		
Striped Bass			585	21,434	119	31,414	187,630	17,557		13					258,752		
Stingaree												365			365		
Suckers						273									273		
Surf Fish																	
Swordfish																	70
Tomcod								13,231							13,231		
Trout—Farm																	
Trout—Steelhead																	
Tuna												27,580			27,580		
Tuna—Bluefin																	
Tuna—Yellowfin																	16,823
Turbot			479												479		
Whitebait	1,705		135					2,057		40					3,937		
Whitefish												2,256		5,890	8,146	371	2,085
Yellowtail												44,341	420	70,188	114,949	139,256	197,959
Miscellaneous		4,700		1,027			670	23,631	1,581	1,653	9,413	24,390	174	536	67,775	2,041	2,997
Total Fish	49,998	51,168	52,198	61,305	42,279	86,871	376,728	3,326,244	356,729	19,406,780	176,636	54,776,232	89,436	4,396,230	83,248,834	1,140,331	717,854
Crustaceans:																	
Crabs	[1]142,680	[2]3,744	[3]10,680				[5]120	[6]294,000	[7]1,056	[8]216					452,496		
Ecrevisse																	
Shrimps			32,428					199,999							232,427		
Spiny Lobsters											26,121	54,348	4,645	40,273	125,387	11,300	355,753
Mollusks:																	
Abalones			40							80,295	7,707				88,042		
Clams—Cockle	3,390		10,841									3,076			17,307		
Clams—Mixed	5,856		2,422												8,278	397	400
Clams—Pismo									720		52,387				53,107		
Clams—Softshell		490	16,880				41,083	12,412							70,865		
Cuttlefish								4,718	16,782	20,798					42,298		
Limpets																	
Mussels							280	1,345	50	790	35		1,000		3,500		
Oysters—Eastern			[4]210,234												210,234		
Oysters—Native																	
Snails																	
Squid										120		76,630		925	77,675	4,381	
Miscellaneous:																	
Frogs																	
Terrapins																	
Turtles																785	1,050
Totals	201,924	55,402	335,723	61,305	42,279	86,871	418,211	3,838,718	375,337	19,508,999	262,886	54,910,286	95,081	4,437,428	84,630,450	1,157,194	1,075,057

All amounts shown in pounds. [1]5,945 doz. [2]156 doz. [3]445 doz. [4]955,608 shell oysters. [5]5 doz. [6]12,250 doz. [7]44 doz. [8]9 doz.

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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

Volume 9 SACRAMENTO, OCTOBER, 1923 Number 4

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THE WOLVERINE.

By Walter Fry, In Charge, Nature Guide Service, Sequoia National Park.

The Sierra Nevada wolverine (*Gulo luscus*), is making his last stand. The animal is found in the high sierra between 6500 and 13,000 feet and is making a losing fight. Man is an enemy who seeks to kill the wolverine at every opportunity; while the porcupine, when captured as food by the wolverine, proves a fatal meal, his sharp quills puncturing the wolverine's intestines and causing painful death within from seven to ten days.

Range of the Wolverine.

Wolverine formerly ranged in the forests of the colder parts of North America from the northern limit of timber line south to New England and New York; in the Rocky Mountains south to Colorado, and along the Sierra Nevada Mountains to Mount Whitney and Sequoia National Park, California. The inroad of settlement, the persistent hunting and trapping of the animal for its beautiful fur, the enmity the animal has gained by reason of its bad morals, as well as his taste for porcupine, has resulted in the animal's becoming extinct over the greater portion of its former range. Where still found, the individuals are few and scattered.

The last stand of the wolverine is in the western part of its range and it is becoming very rare. Wolverine are most abundant in the vicinity of Mount Whitney and Sequoia National Park. This fact is, perhaps, due to the ruggedness of the country and the protection afforded by the National Park service. Many of the animals have been killed in recent years near the park and were, no doubt, products of the park. The last capture was at Mineral King during the winter of 1921-22. Three animals were taken. All were fine specimens and in excellent condition. The largest weighed about 25 pounds. One of these skins is now on exhibit at the park museum at Giant Forest. This catch practically wiped out the species in the Mineral King district for the tracks of but one animal have since been observed in that vicinity.

Family and Description.

The wolverine is by far the largest and most formidable member of the weasel family. It is a strong, heavy-bodied animal seldom weighing over 25 pounds or exceeding 22 inches in height or 40 inches in length, with a tail about 8 inches long, covered with long, coarse hairs drooping to a brush. The head is short and wide with powerful jaws set with heavy teeth. The legs are short and heavy and the feet are armed with long, sharp claws. The coloring of the pelage is unique and beautiful being mixed with black, yellow and gray. The front and sides of the head are grayish while the body is black varying to chestnut brown with a broad, undefined yellowish band along the sides and over the hips, meeting at the base of the tail.

King Beast of the Sierras.

The wolverine, commonly speaking, is not an aggressive animal but will fight desperately when attacked or for the care of its young. When once engaged in combat the beast knows no such thing as retreat, dying, if need be, but never falling back. He fights on as long as a single spark of life remains. Mountain lion, bear and mountain coyotes, whether coming singly or collectively upon a wolverine, seem to fully realize his ferociousness and quickly give way to his path. They know, through long experience, that this is an animal which must be let alone so undoubtedly believe in the logic of "live and let live." The wolverine not only expects the larger animals to let him alone but requires them to give up their own prey and permit him to satisfy his gluttonous appetite.

That the wolverine ranks as king beast of the sierras, to me there is not a shadow of doubt. This fact is borne out by reason of my own observations as well as those of others who have noted their conduct toward other wild animals at certain times and at various places within Sequoia National Park—a few instances of which I will relate:

July 30, 1906—Two adult bear, one black and one brown, gave over to one adult wolverine, with excitement and great haste at Buck Canyon, the carcass of a cow upon which they were feeding.

October 1, 1907—Three large mountain coyotes that were feeding on the carcass of a horse at Grouse Flat vacated the vicinity immediately upon the approach of one medium-sized wolverine.

September 30, 1908—One large and one medium-sized mountain lion were feasting on a deer that they had recently killed at Willow Meadows, but after much growling and threatened resistance on the part of the larger lion both gave way to the approach of one medium-sized wolverine.

Feeding Habits.

The wolverine has no winning bursts of speed to catch his food supply; nor has he the gift of stalking his quarry. His lack of speed and skill has forced the animal to be a scavenger and eat anything in the way of flesh that is captured or found dead. He has a voracious appetite but no doubt can fast for many days, a condition to which he is often forced during the deep snow of winter. Because of his voracious appetite the animal is often called the "glutton." This seems appropriate, for not elsewhere in North America do I know of a mammal in proportion to its size with such capacity for coarse food at one given time, or which has such powerful organs for the digestion, as that of the wolverine. His principal food in the Sierra Nevada consists of the yellow-bellied marmots, carrion, gophers, rats and mice, with occasional sick or crippled wild animals which he is able to drag down. With his long claws and great strength he can dig very rapidly and catch many of the smaller rodents in their burrows. The wolverine does not hunt in mass formation, as do the wolves, but simply braves it alone in a solitary way.

Wolverine are tireless wanderers and do most of their traveling at night but when forced by hunger they will hunt by day. They have but little migratory impulse and usually remain in the vicinity where born. They do not dig burrows in which to live or for shelter and protection, as do some of their smaller brethren, but simply lie down in places at random, usually under some shelving rock or at the base of a tree.

Bad Morals.

The wolverine has very bad morals that have gained him the enmity of not a few. It often follows the trap lines of fur trappers, eating or destroying the catches, baits, and, at times, dragging away the traps.

It will also occasionally invade the rangers' and trappers' cabins by tearing a hole through the roof or side wall, destroy the food contents, and what it can neither eat nor carry away it defiles in such manner as to render it unfit for use. A wolverine will expend a surprising amount of labor in the carrying off and burying of foodstuffs and often include other articles for which it has no use.

Personal Experiences With Wolverine.

The tradition that wolverine are ready to attack any human being gives the impression of a very dangerous animal; but I regard it as pure fiction. On two occasions have I come upon wolverine alone in the daytime in their natural haunts in the Sequoia National Park, where they had probably never before been disturbed by man. Neither time did they show any signs of combat. From the actions of these two animals I base my belief that the wolverine will, under any ordinary circumstances, give way to the presence of man.

It was on the morning of August 31, 1905, that I came upon my first wolverine in the free state of his existence at the eastern edge of Giant Forest on the Alta trail, elevation 7500 feet. The animal was a very large one and was busily engaged in an effort to dig a "ground hog" from an embankment a few feet off the trail. He was making rapid progress. So determined was the animal in the pursuit of his quarry that not until I had approached within less than forty feet did he notice my presence; and when he saw me in such proximity it gave him a great shock of surprise and amazement such as he had perhaps never before had in his life—as was clearly demonstrated by his actions. He immediately sprang upon a large fir log at the butt of which I was standing and turned facing me, gave a coarse guttural growl and showed his teeth. His small, black, beadlike eyes were focused directly at my countenance as if to detect any signs of hostility. His nose was then hoisted high in the air as if to determine the unusual scent; the ears, which with respect to size and shape, resembled two silver dollars, stood well out from the head as if to grasp any unusual sound; the white, pearly claws of the front feet were occasionally scratched on the bark of the log as if preparing for immediate use in warfare.

After remaining in this statuesque attitude for some five minutes the beast advanced slowly on the log toward me and looked me direct in the face. When he had approached within about fifteen feet he suddenly stopped as if to collect his philosophical mind in reasoning out a proposition where death threatened him. His advance seemed for the purpose of getting a better look at me in order to ascertain more accurately as to just what sort of a being I was, or whether or not I was a hostile genus or hereditary enemy, for he showed no signs of anger, fear or aggression. However, at that very critical moment I had my pistol leveled at his heart and my finger on the trigger, with the expectation of matching my skill in marksmanship against his temper and grit in case he showed evidence of combat. He stood for a few seconds scrutinizing me from head to foot, then began to retreat by walking backwards on the log whence he came, for a distance of some thirty feet, sprang to the ground and departed in the forest. I followed the animal for a distance of some two hundred yards, but all the while he kept his distance and close watch of me by looking back over his shoulders. On three different occasions I stamped my feet rapidly on the ground as if in running pursuit, and on each occasion he would immediately right-about-face and advance a few steps toward me. Having amused myself after this fashion for some few minutes, the animal was permitted to go his own way into the depths of the forest.

The second wolverine I met was on the afternoon of July 30, 1906, at Buck Canyon, seven miles east of Giant Forest, elevation 7800 feet. This was the same animal to which I have referred as having driven two bears away from a carcass. Two men and myself in hiding some 150 feet away watched this affair without any of the animals detecting our presence. After the fracas had ended between the three animals and the wolverine was in possession of the carcass, I decided to make a test as to whether or not he would yield on my approach. I shifted my position by crawling a few paces to a huge boulder that stood within about fifty feet of him and between us. I then crawled up to the boulder, peeped round one side, and for a few moments watched his method of repast. The bears had left little but large bones which they were unable to chew; however, the wolverine crushed these as if they were mere chalk and swallowed them with rapacious delight. After watching the animal for some five minutes, pistol in hand, I stepped out in plain sight and advanced slowly toward him. The wolverine looked up at me, gave a coarse growl, grabbed a large bone in his mouth, then walked slowly into the depths of a dense cherry thicket.

Do Wolverines Climb Trees?

The question is often asked: "Do wolverines climb trees?" To this I would say that never have I seen wolverines climb trees, but I have a verified record of such.

The occurrence took place during the month of May, 1903, at Mineral King, California. Two forest rangers, Clarence W. Fry, Three Rivers, California, and William A. Hindman, Visalia, California, came suddenly upon a wolverine that climbed trees, and without hesitation. The animal, when first routed from its lair, gave a few jumps, climbed up a large fir tree some thirty feet, then backed to the ground quickly. When the animal reached the ground, upon being pursued closely by both men and a dog, it climbed up a second large fir tree a distance of some sixty feet, at which point it was shot and killed by Ranger Fry.

Breeding Habits.

Little is known about the breeding habits of the wolverine. It is supposed that young are born in June and range from one to four in number. Upon two occasions I have come upon beds in Sequoia National Park where young had been born and reared, as was plainly evidenced by the premises and surroundings. The first was found on the north spur of Mount Silliman on September 10, 1909, elevation 10,800 feet. The second was on the south side of Vandever Mountain on September 18, 1918, elevation 11,000 feet. In both cases the choice for beds or dens was under shelving rocks and but little preparation had been made for the occasion. A round-like excavation some six inches in depth and five feet in width, with scant lining of grasses and small pieces of pine boughs, comprised the whole. The strange feature of both lairs found was that no bones of the animals that had fallen victim of their prey could be found, as is always the case in such instances with the lion, bear, fox, wolf and lynx. No doubt these had been consumed by the parent mother as food, or carried away for some distance.

In all my mountain experience I have never yet heard a wolverine, when captured or otherwise, give voice to anything but a coarse, guttural growl. Perhaps through long experience they know the value of silence and prefer to keep secret their general whereabouts.

The wolverine is an animal endowed by nature with the strongest of constitution, philosophical mind and excellent reasoning power. Had this not been the case the species could not, with its many handicaps, have survived to this time. The wolverine's sense of smell and hearing is fair but his vision is short and his shape such that he is a poor runner. They do not hibernate in winter, as do the bear, but are forced to hunt daily for their living. Neither do they migrate to lowlands during deep snow periods in winter, as do many other animals, but brave the storm-swept elements on upper timber line where it would seem that no living thing could exist.

Should the Wolverine Be Protected or Exterminated?

The wolverine forms one of the most interesting members of California's fauna and steps should be taken for its immediate protection. Its extermination, to me, seems a very serious crime in which man will be held to strict accountability. Furthermore, I believe that these animals have played an important part in helping to save the larger game animals during attacks of contagious diseases by consuming as food the dead and sick animals, thus preventing spread of the contagion.

So the question now at issue is, "Is the wolverine worth while?" If so, it should be protected. If the wolverine is not worth preserving, at its present rate of extinction it will soon go down and out and will pass to join in history the mastodon and mammoth of the past.

NOTES ON THE EGG YIELD OF SACRAMENTO RIVER KING SALMON.

By E. A. McGregor.

Last year the writer prepared a report on the egg yield of Klamath River king salmon.[1] The present paper continues this study as applied to 50 female king salmon taken in the Suisun portion of the Sacramento system.

The method of computing the number of ova has been the same in all of these studies, namely, careful weighing of the ovaries, determining the number of ova per 10 grams, and then calculating the total number. This method is really accurate enough for all purposes.

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[1] "Observations on the Egg Yield of Klamath River King Salmon," California Fish and Game, Vol. 8, No. 3.

TABLE No. 1. Analysis of 50 King Salmon Females as to Length and Ovary Characteristics.

Fish number		Weight, left ovary, grams	Weight, right ovary, grams	Eggs in left ovary	Eggs in right ovary	Total egg count	Length of fish, cm.
1		104	113	2,309	2,486	4,795	95
2		226	224	2,599	2,554	5,153	78
3		254	298	2,438	2,891	5,329	98
4		71	60	2,812	2,586	5,398	59
5		230	215	2,898	2,666	5,564	87
6		204	219	2,652	2,935	5,587	82
7		211	216	2,870	2,938	5,808	82
8		311	278	3,110	2,780	5,890	94
9		119	120	2,999	2,940	5,939	72
10		340	367	2,822	3,156	5,978	96
11		351	279	3,475	2,734	6,209	92
12		269	271	3,201	3,144	6,345	90
13		157	178	2,983	3,364	6,347	87
14		427	463	3,160	3,426	6,586	88
15		566	520	3,396	3,224	6,620	97
16		273	260	3,385	3,250	6,635	82
17		417	418	3,419	3,219	6,638	94
18		580	505	3,654	3,182	6,836	101
19		175	156	3,640	3,245	6,885	98
20		448	411	3,494	3,411	6,905	101
21		338	313	3,617	3,349	6,966	93
22		201	197	3,517	3,526	7,043	81
23		283	270	3,594	3,483	7,077	88
24		301	356	3,191	4,023	7,214	87
25		404	433	3,474	3,767	7,241	96
26		311	295	3,639	3,717	7,356	91
27		446	468	3,613	3,791	7,404	100
28		372	402	3,683	4,020	7,703	95
29		583	632	3,731	4,045	7,776	103
30		571	676	3,597	4,264	7,861	69
31		603	658	3,859	4,277	8,136	101
32		562	582	4,215	4,016	8,231	97
33		478	476	4,159	4,141	8,300	99
34		513	519	4,155	4,152	8,307	99
35		170	209	3,910	4,410	8.320	86
36		437	417	4,326	4,003	8.329	90
37		438	376	4,687	3,647	8,334	99
38		590	553	4,366	4,092	8,458	97
39		595	515	4,641	3,863	8,504	103
40		661	683	4,230	4,303	8.533	100
41		514	514	4.215	4,369	8,584	100
42		513	472	4,566	4,201	8,767	100
43		525	444	4,777	4,085	8,862	102
44		555	543	4,551	4,398	8,949	106
45		674	696	4,447	4,524	8,971	99
46		382	396	4,431	4,594	9.025	97
47		884	873	4,685	4.627	9 312	110
48		360	389	4,500	5,018	9 518	99
49		150	155	4,845	4,774	9 619	72
50		457	498	5,484	5,528	11,012	88
	Average					7,422	

The present series (see Table 1) varies from 4795 to 11,012—a range of 6217, with a mean value of 7422. Twenty-seven fish had more ova in the left ovary while 23 fish had a greater number in the right ovary. This agrees with the condition found by Snyder to obtain with his Klamath River series, but is the reverse of the writer's findings with his ovary counts from the Klamath. Evidently neither ovary consistently exceeds in the number of ova.

Figure 31 presents a frequency chart in which are indicated the egg counts of the 98 king salmon from the Klamath River (previously treated in the above cited paper) as well as the egg counts of the present series. Thus Klamath River and Sacramento River data are plotted side by side. The class interval is 200 eggs.

It is of great interest to note that the respective graphs (Klamath and Sacramento) each constitute, in the main, compact "curves," well defined from each other. The Klamath group is somewhat more symmetrical, probably owing to the presence of about double the number of cases. Doubtless a more symmetrical "curve" would have resulted in the case of the Sacramento data had we been in a position to chart twice the number of cases.

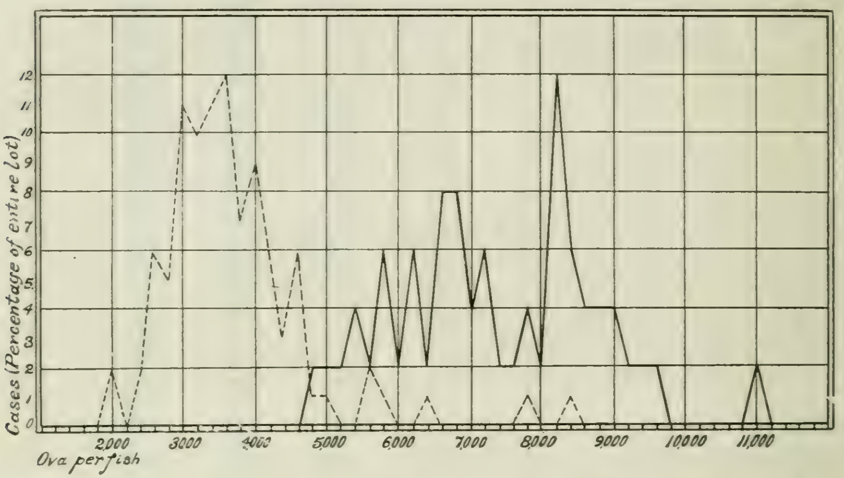

FIG. 31. Graph showing frequency distribution of the total egg counts in a collection of 98 king salmon from the Klamath River and a collection of 50 king salmon from the Sacramento River. (The horizontal ordinates represent percentages of the entire number of cases; the broken lines form the Klamath "curve"; the solid lines form the Sacramento "curve.")

In this connection it is pertinent to quote from our earlier paper:

> There are four or five cases which do not conform nicely with the mass distribution of the series (Klamath). Concerning these aberrant cases, all we can offer by way of explanation is that it is barely possible that these fishes belong to a race or races of salmon alien to the Klamath River or to unusual races native to the Klamath River. If the former hypothesis be true they may be either "stragglers" or fish that have become established through the transplantation to the Klamath system of eggs from other streams.

A glance at figure 31 shows how nicely the above aberrant cases of the Klamath series coincide with the distribution of the Sacramento series. It is quite probable that these cases were in reality typical fish of the Sacramento race.

The mean value for the Sacramento egg counts, as already stated, is 7422 as opposed to 3891 for the mean of the Klamath series. However, the most outstanding feature to be detected through a comparison of the egg counts of the two river races is that there is almost no overlapping of the two series. Where one ends the other begins. Hence, it seems safe in stating that a salmon in the Klamath River with over 5000 ova is very possibly a Sacramento River fish: while a salmon in the Sacramento River with less than 4800 ova is probably alien to that stream, and quite possibly of the Klamath race.

As in the case of the Klamath ova studies, described in the earlier paper, so with the present series, there appears to be a correlation between the length of the fish and the number of ova. The third of the series with the fewest eggs average 92.4 cm. in length; the middle third average 93.8 cm.; while the third with the most eggs average 96.9 cm. in length.

Concerning the possibility of a relation between age and number of ova, little could be established with our material since the scales of some of the fish had commenced to become absorbed, making age determination impractical in such cases.

Certain workers have previously expressed the opinion that the Sacramento salmon exceeds in number of ova per fish that of the Klamath salmon. The results of the present studies compared with those reported in the 1921 paper establish the validity of these hitherto unproven views.

An interesting outgrowth of these studies is the quite obvious discrepancy between our data on the number of eggs per fish and similar estimates by the hatchery authorities. A hatchery analysis of the egg take at Klamathon for 1921 is as follows: Total females spawned, 5823; total eggs therefrom, 19,178,000; average number of ova per female, 3293. It has been seen that our data yields a mean ova value per female of 3891 for the Klamath race, the mode being at 3600 approximately. This means that we find about 18 per cent more eggs per female among fish of the spawning run at Requa (near mouth of river) than are spawned at the racks—based on hatchery estimates. Again, we are told that the records of the Battle Creek Hatchery, together with other evidence, show that the Sacramento salmon yields an average of about 6000 spawned ova per female. As we have stated, our careful counts indicate a mean value of 7453 eggs per set of ovaries for females from the Suisun district of the Sacramento system. This represents about 24 per cent more ova among fish of the spawning run near Martinez than are secured at the Battle Creek egg-taking station.

Just how to account for these discrepancies in egg counts a short time prior to and at spawning time is problematical. The theory might be advanced that, contained in the ovaries are certain ova, smaller than the general mass of ova, that become absorbed prior to spawning. It must be admitted that a small proportion of the ovaries examined have contained a negligible number of abortive ova, but an effort was made to eliminate these few undeveloped eggs from our estimates. Since absorption of these abortive ova presumably would advance (provided absorption occurs) with the maturing of the general mass of eggs, one would therefore expect (on this hypothesis) ovaries with further advanced eggs to exhibit, in general, egg counts somewhat less than the average for a given lot. On the contrary, as may seem strange, of that portion of the females containing eggs in excess of the mean number, about 75 per cent possessed eggs averaging larger than the average size of the entire lot. Consequently we are forced to the conclusion that the phenomenon of egg absorption does not operate to reduce the number of ova just prior to spawning.

We will leave the solution of this discrepancy between egg counts and egg estimates for a later problem.

In conclusion then, our studies indicate a very marked difference between the number of eggs developed by king salmon females of the Klamath and Sacramento races, respectively. Taking the weighted means as representative of the egg yields of the two river races (3891 and 7422), the number of eggs per female of the Sacramento type may be said to exceed that of the Klamath type by about 91 per cent of the Klamath yield.

As previously pointed out, these facts possess an economic bearing which may be utilized in practice at some later date.

A POSSIBLE SEPARATION OF THE RIVER RACES OF KING SALMON IN OCEAN-CAUGHT FISH BY MEANS OF ANATOMICAL CHARACTERS.

By E. A. McGregor.

In connection with certain studies of rather ample series of gill rakers, pyloric coeca, branchiostegals and ova, and a limited number of vertebrae, some very suggestive developments have accrued which appear to bear vitally on the problem of the race analysis of ocean-captured salmon.

In the work of systematists, dealing previously with the Pacific coast salmon species, seemingly they have not had access to large series of specimens or, if they had, possibly they did not go to the trouble of tediously counting large series of the structures listed above. Consequently the ranges in their several series are not so great as might have been, and their data appear not to have aroused serious speculation as to the existence of well defined intraspecific racial differences. Recent studies by Dr. Chas. H. Gilbert, especially in the case of the sockeye salmon, have established the occurrence of several local races in British Columbia and Alaska.

In the following pages we shall attempt to present the data accumulated to date in such a way as to be useful in the future in connection with similar analytical studies of ocean-caught salmon.

Ova Counts.

In another paper[1] the writer has presented data emphasizing the marked difference in the number of ova as between the Klamath River and Sacramento River races of king salmon. Since preparing this paper we have added somewhat to our Klamath series, so we will again present the ova counts of the two races, bringing the comparisons up to date.

Table I presents the full series, consisting of 111 Klamath River king salmon. These were collected at three different times as follows: Those designated "S" were collected by Professor Snyder at Requa in 1920; those marked "R" were collected by the writer at Requa in 1921; those listed as "K" were collected by the writer at Klamathon (towards the head of the river) in 1922.

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[1] "Notes on the egg yield of Sacramento River king salmon" (In the present number of CALIFORNIA FISH AND GAME).

TABLE I. KING SALMON OVA COUNTS, KLAMATH RIVER.

No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date
R 8406	105	Sept. 1	R 3953	90	Aug. 24	R 3298	74	Aug. 27
R 7946	95	Sept. 5	S 3935	84	Aug. 12	R 3277	100	Sept. 2
R 6468	79	Sept. 2	R 3932	81	Aug. 27	K 3265	71	Oct. 17
R 5975	107	Sept. 3	R 3905	86	Aug. 18	R 3256	86	Aug. 12
R 5658	105	Sept. 6	R 3901	81	Sept. 1	S 3200	82	Aug. 12
R 5656	91	Aug. 9	S 3886	78	Aug. 12	R 3181	69	Aug. 19
R 5159	100	Sept. 3	K 3792	83	Oct. 19	R 3175	84	Aug. 31
K 4977	--------	Oct. 20	S 3781	82	Aug. 11	K 3174	80	Oct. 12
S 4842	87	Aug. 12	R 3743	87	Sept. 2	R 3139	70	Sept. 1
R 4728	93	Aug. 25	S 3731	84	Aug. 11	K 3130	--------	Oct. 20
R 4713	92	Aug. 20	R 3707	84	Aug. 26	S 3110	84	Aug. 11
R 4692	92	Aug. 22	K 3702	81	Oct. 20	R 3101	80	Aug. 24
R 4666	92	Aug. 26	S 3676	83	Aug. 12	S 3083	80	----------
R 4650	90	Aug. 27	S 3672	81	Aug. 12	R 3075	77	Aug. 20
R 4612	95	Sept. 1	R 3645	69	Aug. 12	R 3070	76	Aug. 24
R 4586	89	Aug. 15	S 3630	83	Aug. 12	K 3057	73	Oct. 12
K 4544	86	Oct. 15	R 3625	70	Aug. 20	R 3046	81	Sept. 6
K 4479	84	Oct. 15	R 3623	88	Aug. 25	R 3046	71	Aug. 22
R 4452	--------	----------	S 3614	83	----------	R 3035	--------	----------
R 4429	91	Aug. 9	R 3613	81	Aug. 15	R 2973	68	Aug. 16
R 4399	94	Aug. 16	R 3593	86	Aug. 24	S 2949	77	Aug. 12
S 4392	87	Aug. 12	S 3586	75	Aug. 12	K 2944	72	Oct. 12
R 4322	69	Aug. 1	S 3579	69	Aug. 12	S 2879	72	Aug. 12
R 4305	91	Aug. 18	R 3553	78	Aug. 31	S 2847	77	Aug. 12
S 4300	82	Aug. 12	R 3537	75	Aug. 18	R 2823	70	Aug. 24
S 4200	87	----------	R 3523	82	Aug. 25	K 2830	75	Oct. 15
S 4197	77	Aug. 12	R 3486	91	Aug. 31	S 2745	80	Aug. 12
S 4192	83	Aug. 12	S 3467	81	Aug. 12	R 2738	73	Aug. 31
R 4190	79	Aug. 19	R 3446	88	Sept. 3	S 2700	79	Aug. 12
R 4168	86	Aug. 16	R 3413	71	Sept. 5	R 2695	85	Aug. 16
R 4155	89	Aug. 26	S 3403	79	Aug. 12	R 2632	68	Aug. 15
R 4150	80	Sept. 5	R 3373	73	Aug. 16	R 2601	66	Sept. 2
S 4117	95	Aug. 12	R 3360	71	Aug. 26	R 2501	61	Aug. 12
R 4061	--------	----------	R 3347	77	Aug. 4	R 2471	65	Aug. 27
K 4039	84	Oct. 17	S 3305	71	Aug. 12	S 2146	67	Aug. 28
S 4009	80	----------	R 3305	66	Aug. 18	R 2013	92	Aug. 15
R 3994	93	Aug. 19	R 3303	86	Aug. 19	K 1718	55	Oct. 13

Mean value, 3760 ova.

It will be noted that there is a wide range in the number of ova, namely, from 1718 to 8406 per female. The computed mean value for the series is found to be 3760 ova. It is not unlikely that a more detailed study of the Klamath River salmon may demonstrate the existence of several more or less recognizable local subraces characteristic of certain tributaries.

It will be further noted that the seven individuals at the maximum extreme of the series constitute (with a single exception) a homogeneous group. All but one returned to the stream during September and all, with one exception, were very large females. As will be seen later, evidence would seem to indicate that the females with over 5000 ova (although taken in the Klamath River) may be of the Sacramento race.

Table II presents our available data dealing with the ova counts of 50 king salmon of the Sacramento system, taken at Martinez, September, 1922.

Here too, we find the existence of a remarkably large range in the number of ova per female. The extremes were, respectively, 4795 and 11,012 ova per female. The computed mean for this series was found to be 7454 ova, almost double the mean of the Klamath series. As we have surmised regarding the Klamath River salmon, so also with the Sacramento run, it is quite likely that more exhaustive studies of the salmon of this river may bring to light the occurrence of several local subraces.

TABLE II. KING SALMON OVA COUNTS, SACRAMENTO RIVER.

No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date
11,012	88	Sept. 6	8300	99	Sept. 6	6635	82	Sept. 6
9619	72	Sept. 7	8231	97	Sept. 6	6620	97	Sept. 6
9518	99	Sept. 6	8136	101	Sept. 6	6586	88	Sept. 6
9312	110	Sept. 7	7861	69	Sept. 6	6347	87	Sept. 6
9025	97	Sept. 7	7776	103	Sept. 6	6345	90	Sept. 6
8971	99	Sept. 7	7703	95	Sept. 6	6209	92	Sept. 6
8949	106	Sept. 6	7404	100	Sept. 6	5978	96	Sept. 6
8862	102	Sept. 6	7356	91	Sept. 6	5939	72	Sept. 6
8767	100	Sept. 7	7241	96	Sept. 6	5890	94	Sept. 7
8584	100	Sept. 7	7214	87	Sept. 6	5808	82	Sept. 6
8533	100	Sept. 6	7077	88	Sept. 6	5587	82	Sept. 7
8504	103	Sept. 7	7043	81	Sept. 6	5564	87	Sept. 6
8458	97	Sept. 6	6966	93	Sept. 6	5398	59	Sept. 6
8334	99	Sept. 6	6905	101	Sept. 7	5329	98	Sept. 6
8329	90	Sept. 6	6885	98	Sept. 6	5153	78	Sept. 6
8320	86	Sept. 7	6836	101	Sept. 7	4795	95	Sept. 6
8307	99	Sept. 6	6638	94	Sept. 7			

Mean value, 7453.8.

Table III contains the ova counts from 58 king salmon taken by troll in the ocean off Noyo River and Shelter Cove, Mendocino County, during the period from June 21 to August 12, 1922.

TABLE III. KING SALMON OVA COUNTS, FORT BRAGG—1922.

No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date	No. of ova	Length, cm.	Date
9021	79	June 23	5093	83	July 8	3910	66	June 25
8829	73	June 24	5042	81	June 23	3867	77	June 22
8258	70	July 6	4960	88	July 1	3854	80	July 10
7618	95	Aug. 11	4858	82	June 26	3646	81	June 25
7272	67	June 26	4783	88	June 26	3614	76	June 22
7068	77	July 1	4729	83	June 27	3555	82	July 8
6917	77	July 1	4621	85	June 23	3526	93	June 29
6851	78	June 28	4437	83	June 23	3521	77	June 27
6715	85	June 21	4377	75	June 23	3497	78	June 21
6358	109	June 29	4330	75	June 26	3477	73	July 7
6309	77	June 23	4297	98	July 1	3487	79	June 27
6287	90	Aug. 5	4247	98	July 26	3390	78	July 10
6269	61	June 27	4148	74	July 20	3344	--------	--------
6192	79	June 22	4142	--------	--------	3321	94	June 21
6008	76	July 3	4062	87	June 26	3317	75	June 30
5972	58	June 25	4035	78	June 22	3266	--------	--------
5768	93	Aug. 12	4033	76	June 26	3214	--------	--------
5450	78	June 23	4018	--------	--------	3147	78	June 27
5370	88	June 26	4008	81	June 29			
5094	72	July 1	3988	98	June 21			

Mean value, 4910 ova.

Again we note a very considerable range, namely, from 3147 to 9021 ova per female. The mean is computed to be 4910.

In figure 32 we have constructed three "curves" based on the data contained in tables I, II and III. In these graphs the data have been recorded in terms of percentage rather than of absolute values. A few very significant facts are to be deduced from the presentation of our data in this manner.

Referring to figure 32 it is at once noticeable that the "curves" representing respectively the Klamath and Sacramento ova series are quite distinct from one another. Were we to ignore the six aberrant cases of the Klamath series (referred to above as probably belonging to the Sacramento race), we might say there were little, if indeed any, overlapping of the two "curves." The cleavage between the two series would appear to be coincident approximately with the 5200 ordinate.

A third "curve" will be noted in figure 32. This is constructed from the data embracing the ova counts of the series of king salmon females from the ocean at Fort Bragg. This "curve" is plotted in direct relation with the "curves" of the Klamath and Sacramento series. When considered together, we find that the ocean "curve" is nearly coextensive with the combined Klamath and Sacramento "curves." Corresponding with the cleavage between the series of the two rivers there is seen to be similarly a fairly well defined cleavage at the 5200 ordinate of the Fort Bragg "curve." Below the cleavage there are 41 cases; above the cleavage, 17 cases.

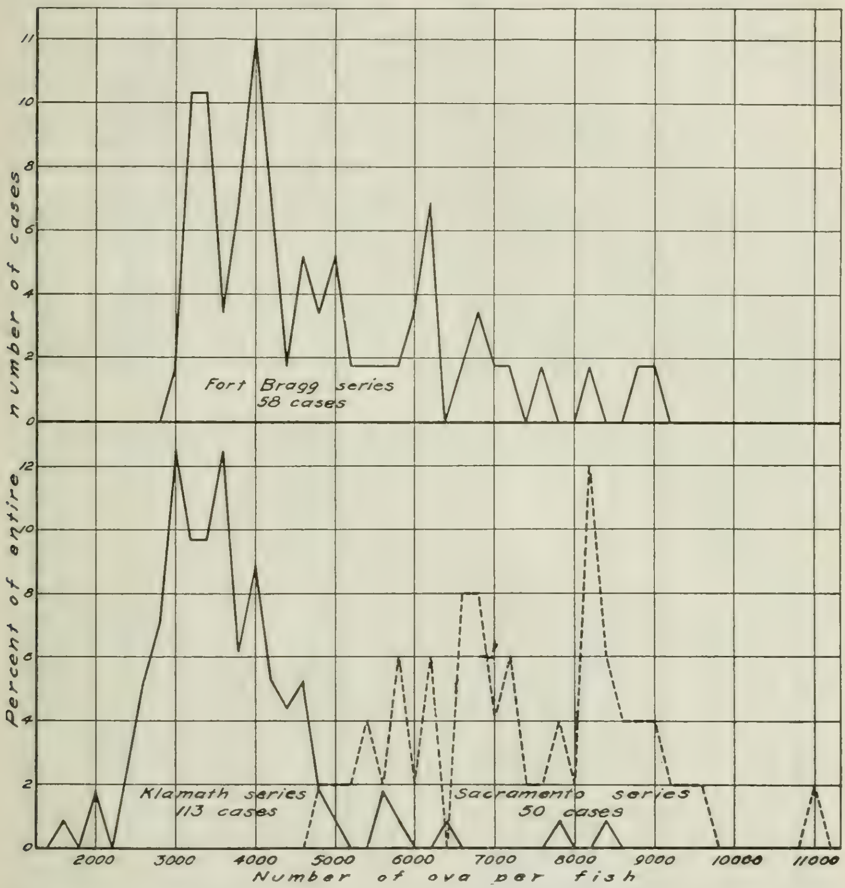

FIG. 32. Graph comparing number of ova per fish in Fort Bragg, Klamath and Sacramento series of salmon.

It is possible, of course, that there may be represented in the Fort Bragg series salmon from streams other than the Sacramento and Klamath Rivers. It seems, however, quite reasonable to presume that the great majority of king salmon occurring off Fort Bragg belong to the two California streams which support the major runs of the state. If this supposition be true, our ova data would seem to justify the rough estimate that 70 per cent of the king salmon caught off Fort Bragg and Shelter Cove during the period of our observations in 1922 were of the Klamath race while only 30 per cent of these sea-caught fish were of the Sacramento race. It should again be emphasized that our data from Fort Bragg were collected at various dates, representing fairly well the major portion of the fishing season at that locality.

One might attempt a more refined interpretation of the several "curves" than we have done. The depression of the Sacramento "curve" at about the 7500 ordinate may or may not be significant. It is quite possible that accessibility to a larger series of individuals might obliterate this apparent cleavage. Should a depression of the "curve" at this point persist with the study of a very large series of ova, it would indicate strongly the occurrence in the Sacramento River system of at least two races of salmon with rather distinct ova count values. It may indicate a demarkation between Sacramento and San Joaquin River fish.

TABLE IV. PYLORIC COECA DATA FROM KLAMATH RIVER KING SALMON.

Number of coeca	Average length of 3 longest, cm.	Length of fish, cm.	Date	Locality	Number of coeca	Average length of 3 longest, cm.	Length of fish, cm.	Date	Locality
193	5.9	67.5	Oct. 10, 1919	R	131	8.3	92.5	Oct. 8, 1919	R
187	4.7	60.0	Oct. 11, 1919	R	130	3.7	83.0	Oct. 13, 1919	K
164	7.3	87.0	Oct. 7, 1919	R	130	3.2	82.0	Oct. 12, 1922	K
153	5.4	--------	Aug. 28, 1919	R	130	4.3	53.0	July 30, 1920	R
152	11.0	--------	Aug. 28, 1919	R	128	7.5	--------	Aug. 28, 1919	R
152	8.9	--------	Aug. 28, 1919	R	128	10.5	103.0	Oct. 14, 1919	R
151	7.5	--------	Aug. 28, 1919	R	128	7.5	83.5	Oct. 14, 1919	R
151	7.3	--------	Aug. 28, 1919	R	127	6.9	--------	Aug. 28, 1919	R
150	16.5	--------	--------------	R	127	4.5	--------	Oct. 14, 1919	R
149	3.4	81.0	Oct. 20, 1922	K	127	4.3	73.0	Oct. 16, 1922	K
148	6.1	--------	Aug. 28, 1919	R	127	3.5	68.0	Oct. 13, 1922	K
148	9.7	--------	Aug. 28, 1919	R	125	9.1	--------	Aug. 28, 1919	R
148	7.9	--------	--------------	R	125	9.4	--------	Aug. 28, 1919	R
146	3.2	82.0	Oct. 13, 1922	K	124	4.4	84.0	Oct. 13, 1922	K
145	2.9	77.0	Oct. 13, 1922	K	124	4.4	86.0	Oct. 15, 1922	K
144	9.2	--------	Aug. 28, 1919	R	124	3.2	74.0	Oct. 13, 1922	K
144	8.7	94.5	Oct. 6, 1919	R	124	7.7	--------	Aug. 28, 1919	R
144	5.8	63.5	Oct. 6, 1919	R	123	5.9	55.0	July 30, 1920	R
144	8.3	97.5	Oct. 7, 1919	R	122	8.5	--------	Aug. 28, 1919	R
142	8.1	--------	Aug. 28, 1919	R	121	8.3	--------	Aug. 28, 1919	R
142	2.7	73.0	Oct. 12, 1922	K	119	7.6	--------	Aug. 28, 1919	R
141	7.1	--------	Aug. 28, 1919	R	119	2.1	52.0	Oct. 14, 1922	K
140	2.8	78.0	Oct. 12, 1922	K	119	2.8	77.0	Oct. 16, 1922	K
138	3.0	96.0	Oct. 12, 1922	K	118	3.6	83.0	Oct. 12, 1922	K
136	7.1	60.0	Aug. 4, 1920	R	117	4.3	41.5	Oct. 6, 1919	R
135	8.7	93.0	Oct. 7, 1919	R	116	6.4	--------	Aug. 28, 1919	R
135	8.0	104.0	Oct. 14, 1919	R	114	2.2	80.0	Oct. 16, 1922	K
135	2.8	81.0	Oct. 13, 1922	K	114	6.5	56.5	Oct. 11, 1919	R
134	8.8	--------	Aug. 28, 1919	R	109	--------	81.0	Oct. 12, 1922	K
133	5.8	--------	Aug. 28, 1919	R	108	5.0	--------	Oct. 14, 1919	R
133	3.6	76.0	Oct. 13, 1922	K	107	4.3	82.0	Oct. 12, 1922	K
133	4.6	84.0	Oct. 17, 1922	K	102	--------	55.0	Oct. 13, 1922	K
132	12.1	97.5	Oct. 14, 1919	R	93	4.2	--------	Oct. 20, 1922	K

Average 132.2.

Pyloric Coeca Counts.

We have made also a good many counts of pyloric coeca from the stomachs of king salmon taken at various localities.

A series of 66 king salmon stomachs were collected on the Klamath River and later examined. These were all from mature fish on their spawning run. Forty-two were taken in the estuary at the mouth of the river, the balance, 24, were collected at the Klamath racks, 170 miles upstream from the coast.

TABLE V. PYLORIC COECA DATA FROM SACRAMENTO RIVER KING SALMON.

Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date	Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date
214	7.7	98	Sept. 6	177	7.1	88	Sept. 6
208	9.7	95	Sept. 6	177	7.5	82	Sept. 6
206	4.6	64	Sept. 7	176	4.6	64	Sept. 6
205	2.8			176	8.1	91	Sept. 6
205	4.4	67	Sept. 6	175	6.0	101	Sept. 7
203	9.2	100	Sept. 7	175	9.7	117	Sept. 6
203	5.6	98	Sept. 6	174	9.2	98	Sept. 7
200	11.7	116	Sept. 6	174	6.7	90	Sept. 6
199	8.6	93	Sept. 7	174	6.2	81	Sept. 6
198	8.0	82	Sept. 7	174	10.5	101	Sept. 6
198	9.4	106	Sept. 6	168	7.9	99	Sept. 6
197	6.8	72	Sept. 7	168	6.8	79	Sept. 6
197	8.8	88	Sept. 6	168	6.8	90	Sept. 6
195	7.8	78	Sept. 7	166	8.9	101	Sept. 6
195		88	Sept. 6	165	8.1	99	Sept. 6
[1]195	3.3	84	Nov. 10	165	6.3	92	Sept. 6
194	4.5	57	Sept. 7	164	9.2	87	Sept. 6
194	7.8	97	Sept. 6	163	8.9	103	Sept. 6
193	7.0	94	Sept. 7	164	8.1	88	Sept. 6
[1]193				162	8.1	87	Sept. 6
192	7.3	100	Sept. 7	162	7.1	97	Sept. 6
192	10.0	95	Sept. 5	[1]162	3.0	68	Nov. 8
192	6.2	67	Sept. 6	161	8.2	97	Sept. 6
192	9.4	80	Sept. 6	160	9.4	101	Sept. 7
[1]191	3.8	86	Nov. 11	158	10.5	96	Sept. 6
189	7.9	98	Sept. 6	157	6.3	97	Sept. 6
188	6.5	100	Sept. 6	156	6.4	69	Sept. 6
187	8.3	87	Sept. 6	155	8.9	114	Sept. 7
187	7.2	100	Sept. 6	[1]155	4.3	84	Nov. 3
[1]187				150	6.8	97	Sept. 6
186	8.8	99	Sept. 6	149	5.6	78	Sept. 6
184	6.7	97	Sept. 7	149	8.2	99	Sept. 6
183	8.1	99	Sept. 7	147	8.4	99	Sept. 6
[1]182	2.8	80	Nov. 8	147	10 0	84	Sept. 6
181	8.3	103	Sept. 7	146	5.7	62	Sept. 6
181	7.2	90	Sept. 6	145	9.8	110	Sept. 7
180	8.4	69	Sept. 6	140	7.9	72	Sept. 6
178	7.3	94	Sept. 7	136	7.3	86	Sept. 7
178	9.2	83	Sept. 6	135	9.0	103	Sept. 7
178	9.4	82	Sept. 6	134	4.5	59	Sept. 6
177	8.0	99	Sept. 6				

Average, 176.4.

[1] NOTE.—The few individuals of November in this table were taken at the Klamathon racks on the Klamath River; being marked fish we know them to be of Sacramento River origin and are included with the balance which were taken at Martinez.

The frequency range of this Klamath River series (see Table IV) is from 93 to 193 coeca per stomach, with a mean value of 132.2 coeca. The three highest counts (164, 187 and 193) appear to fall far out of the regular distribution of the series. This is shown more clearly by referring to the graphic plotting of the data in figure 33. It is very probable that these three aberrant cases are individuals belonging to a race other than that normally inhabiting the Klamath River. We have computed that about 93 per cent of all the coeca cases of the Klamath series are contained between the 107 and the 153 ordinates, inclusive.

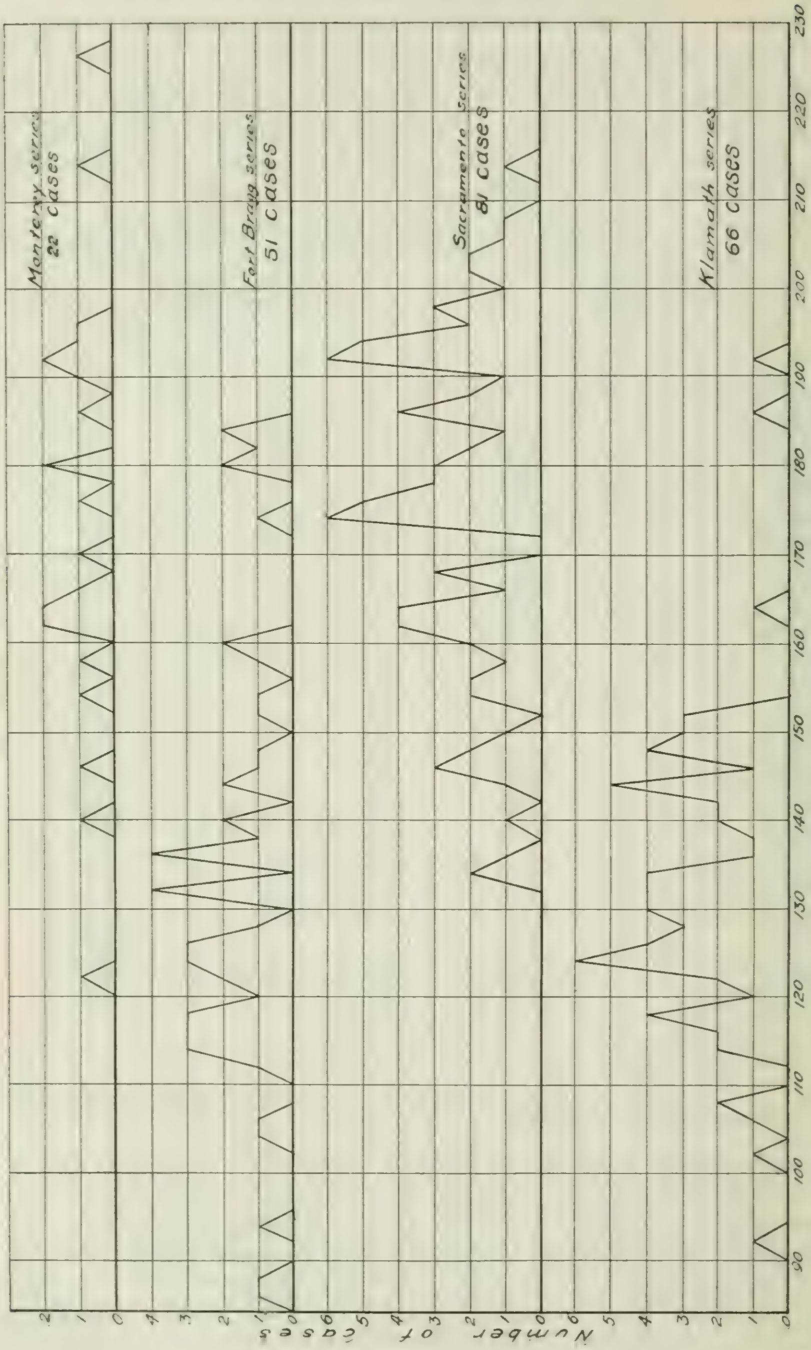

FIG. 33. Comparison of number of coeca in Monterey, Fort Bragg, Sacramento and Klamath series of salmon.

A series of 81 king salmon stomachs were collected at Martinez on Suisun Bay, just below the mouth of the Sacramento River. While there is a possibility that a portion of these individuals may have been heading for the San Joaquin River, still it is more than likely that the great mass, if not all of them, were typical Sacramento River fish and we shall speak of them as such in the present paper.

In Table V we present the coeca counts of this series arranged in orderly sequence. It will be seen that the case distribution ranges from 134 to 214 coeca (about 95 per cent of all the cases occur on the upper side of the 144 ordinate). The mean value for the series is 176.4 coeca.

Referring again to figure 33 we see the coeca counts of the Sacramento River series plotted in relation to the Klamath River counts. As one might expect, there is a degree of overlapping of the "curves" representing the coeca counts of the two great river systems. The striking feature, however, is that the overlapping is so slight! If, arbitrarily, we erect a vertical between the 153 and 154 ordinates, the Sacramento cases below this division line constitute but 13.5 per cent of the entire Martinez lot, while the Klamath cases above this dividing line amount to only 4.5 per cent of all the Klamath River cases. And, as we have suggested above, some of these overlapping cases probably represent straggling individuals from the stream within whose coeca series they appear to fall. Hence, if we could definitely eliminate these disconcerting cases it would be seen that the pyloric coeca values of the Klamath and Sacramento rivers would become strikingly distinct from one another. As it is, they are sufficiently well separated.

We now will consider the coeca counts of king salmon taken by troll in the ocean off Fort Bragg, Mendocino County. In this series there are 51 cases, ranging from 87 to 185 coeca, with the mean value at 134.1 coeca (see Table VI).

TABLE VI. PYLORIC COECA DATA FROM FORT BRAGG KING SALMON.

Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date	Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date
			1922	132	5.6	41	July 10
185	11.6	78	June 23	129	13.5	82	June 26
185	4.5	---	---	127	11.0	76	July 3
182	8.4	78	June 28	126	10.3	77	July 1
180	12.2	109	June 29	126	11.1	83	June 23
180	9.7	77	June 23	125	14.1	93	Aug. 12
174	11.4	78	July 20	125	11.9	77	July 1
161	---	79	June 23	124	11.6	85	June 23
160	9.0	81	June 23	123	10.3	77	June 22
158	12.0	---	---	123	13.5	90	Aug. 5
155	7.8	70	July 6	121	13.8	88	Aug. 2
152	13.4	---	---	119	10.0	75	June 23
149	9.0	61	June 27	118	12.4	76	June 26
146	8.5	79	June 22	118	11.1	86	July 19
144	9.5	74	June 20	117	11.1	67	June 26
144	8.2	66	June 25	117	11.7	---	---
141	11.1	72	July 1	116	11.5	88	June 26
140	9.8	79	Aug. 2	115	9.5	77	June 27
138	9.5	79	June 27	114	12.2	78	June 27
136	11.3	78	June 21	114	10.3	81	June 29
136	12.7	85	June 21	112	---	81	June 25
136	7.5	58	June 25	107	13.3	75	June 26
136	13.3	95	Aug. 11	105	11.1	78	June 22
132	14.0	83	June 27	94	9.2	76	June 22
132	14.1	88	July 1	88	12.1	79	July 8
132	11.6	---	---	87	---	75	June 30

Average number of coeca, 134.1; average length of three longest coeca 10.9 cm.

It is of much interest once more to attempt to analyze the Fort Bragg salmon with reference to the particular river systems to which they may belong. Such a diagnosis is facilitated by referring again to figure 33. Here we see the ocean series of pyloric coeca counts plotted with reference both to the Klamath and the Sacramento coeca series. Considering as before the typical Klamath and Sacramento individuals to be separable by an ordinate erected between the 153 and 154 coeca values, it is of significance to note where this vertical cuts the Fort Bragg series. The great mass of the Fort Bragg collection is seen to fall below this ordinate. In fact, 80.4 per cent (41 cases) of the coeca counts from Fort Bragg coincide perfectly with the frequency distribution of the Klamath coeca counts (based on the validity of our selected dividing ordinate).

Naturally one must guard against formulating generalities supported by the study of series no larger than our present one from Fort Bragg. As briefly mentioned above, however, these studies covered the interval between June 20 and August 12, a very considerable portion of the commercial fishing season at that locality. The longest hiatus without data was 13 days (July 20 to August 2); the average interval between collections was 2.8 days. It would seem, therefore, that our 51 pyloric coeca counts from king salmon at Fort Bragg might form a reasonably fair basis upon which to compute a purely tentative analysis of the composition of the catch at that point. We may be justified in stating that our data of 1922 rather strongly indicate that the king salmon caught at sea off Fort Bragg during the period of our investigations were chiefly of the Klamath River type.

By referring to Table VI the following facts are to be noted for the Fort Bragg series (provided the two river races are recognizable in our data). First, the Sacramento fish were restricted to the period prior to and including July 20. Second, all August fish had coeca counts between 121 and 140. Lastly, Klamath River salmon were taken throughout the period from June 20 to August 12 (the entire period of observation).

TABLE VII. PYLORIC COECA DATA FROM MONTEREY KING SALMON.

Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date	Number of coeca	Average length of 3 longest coeca, cm.	Length of fish, cm.	Date
			1920	171	2.94	59	June 11
226	2.19	47	June 11	167	2.87	55	June 11
215	3.31	72	June 24	165	4.62	88	June 22
196	2.37	58	June 24	165	4.81	90	June 24
194	3.50	86	June 11	162	3.19	59	June 11
192	3.50	68	June 24	162	2.50	54	June 24
192	4.25	86	June 22	159	3.43	86	June 22
191	3.43	64	June 24	155	4.62	85	June 24
187	2.31	53	June 24	146	6.87	109	June 11
181	4.12	83	June 24	141	5.87	97	June 22
181	4.00	76	June 24	123	5.50	88	June 22
177	2.37	51	June 11				

Mean, 174.9.

The coeca of 22 king salmon caught in Monterey Bay have been counted. This very limited series was collected at intervals during the period between June 11 and June 24, inclusive. The counts (see

Table VII) varied from 123 to 226, with a mean value of 174.9 coeca—almost identical with the mean value of the pyloric coeca series of the Sacramento River fish. These are also plotted in figure 33 (as were the Fort Bragg coeca counts) in direct relation with the Klamath and Sacramento series. It will be seen that our ordinate, selected to best separate the Klamath and Sacramento fish, cuts the Monterey series in such a way as to throw 19 individuals into the Sacramento group and only three individuals into the Klamath series. Reducing these quotas to terms of percentage, the above diagnosis suggests a Sacramento River representation of 86 per cent and a Klamath River quota of 14 per cent of the Monterey series. This collection is far too small to justify serious conclusions and we have included the data merely for what it may be worth.

Gill Raker Counts.

Our third anatomical character which we have utilized in the separation of the Klamath and Sacramento races of king salmon consists of the number of gill rakers on the first branchial arch. As in the case of the ova and coeca counts, so with the gill rakers, we have three series: One each from the Sacramento and the Klamath systems and one from ocean-trolled fish off Fort Bragg.

The data concerning Sacramento salmon were secured from Martinez (on Suisun Bay) and from hatchery fish. The series consists of 35 cases and the counts are as follows: 21 gill rakers, 1 case; 22 gill rakers, 7 cases; 23 gill rakers, 10 cases; 24 gill rakers, 9 cases; 25 gill rakers, 8 cases. Thus we have a range from 21 to 25 gill rakers with a mean value of 23.5 gill rakers.

The data respecting Klamath River salmon were secured from three sources: The estuary at the mouth of the river; the Klamathon racks, far up the river, and at the hatcheries. In all, 51 gill arches were examined with the following results: 24 gill rakers, 2 cases; 25 gill rakers, 3 cases; 26 gill rakers, 10 cases; 27 gill rakers, 10 cases; 28 gill rakers, 14 cases; 29 gill rakers, 9 cases; 30 gill rakers, 3 cases. This yields a range of 24 to 30 gill rakers and a mean value of 27.4 gill rakers.

Our gill raker data in the case of the Fort Bragg king salmon were secured from a series of 51 individuals as follows: 22 gill rakers, 3 cases; 23 gill rakers, 2 cases; 24 gill rakers, 2 cases; 25 gill rakers, 8 cases; 26 gill rakers, 10 cases; 27 gill rakers, 16 cases; 28 gill rakers, 7 cases; 29 gill rakers, 1 case; 30 gill rakers, 1 case; 31 gill rakers, 1 case. Here we have a range in gill raker values from 22 to 31 with a mean value of 26.2.

TABLE VIII. GILL RAKER COUNTS FOR SACRAMENTO, KLAMATH AND FORT BRAGG KING SALMON.

Gill rakers	21	22	23	24	25	26	27	28	29	30	31	Mean
Sacramento River fish	1	7	10	9	8	----	----	----	----	----	----	23.5
Klamath River fish	----	----	----	2	3	10	10	14	9	3	----	27.4
Fort Bragg fish	----	3	2	2	8	10	16	7	1	1	1	26.2

Again it is of much interest to see what can be done in the way of isolating either Sacramento River or Klamath River salmon from the ocean catch at Fort Bragg, using the gill raker counts. By referring to

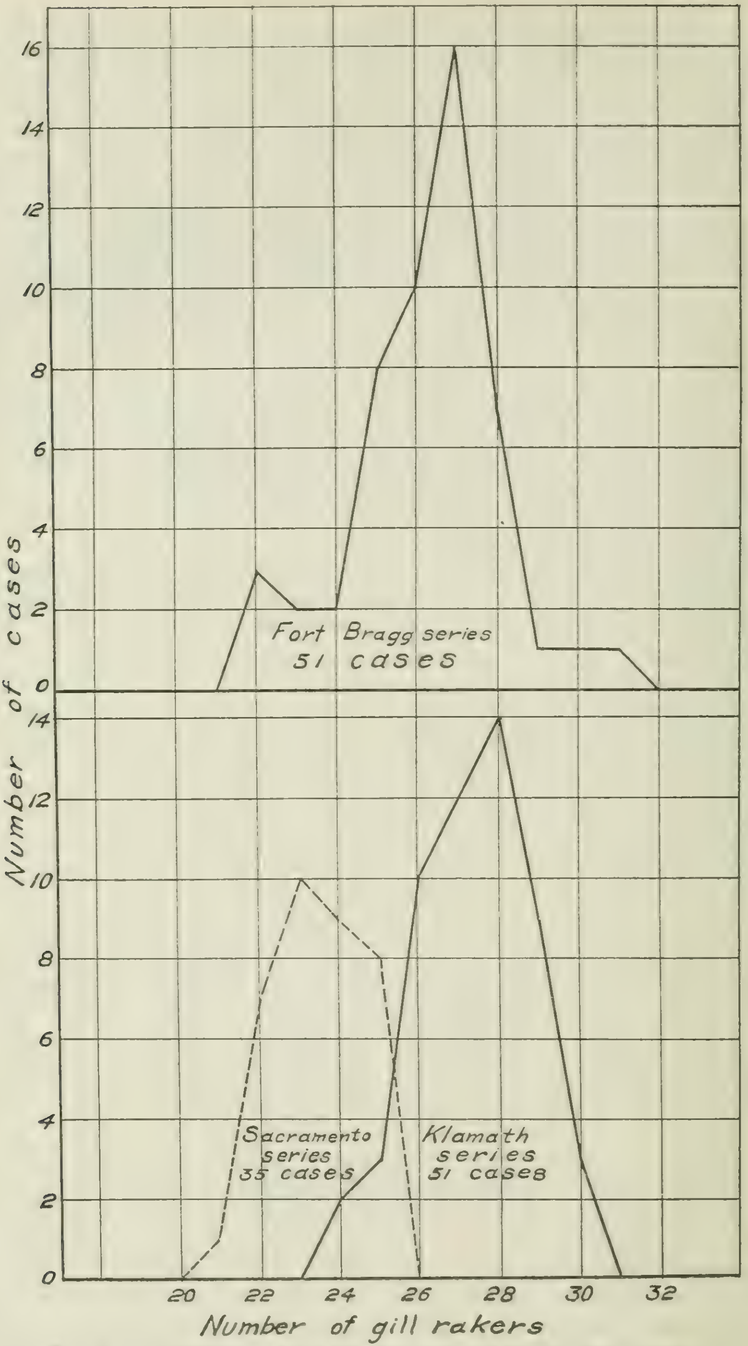

FIG. 34. Comparison of the number of gill rakers in Fort Bragg, Sacramento and Klamath series of salmon.

figure 34 wherein the various gill raker counts have been graphically presented, we are able to fix upon a vertical between the 24 and 25 ordinates as the most logical cleavage line between the gill raker values for the Sacramento and the Klamath River race. It is rather unusual that, whereas in the Sacramento series eight individuals had 25 gill rakers, none had 26. Probably a larger series would contain a few individuals with 26 gill rakers, resulting in a slightly increased overlapping of the "curves." Assuming, then, that five of the Fort Bragg individuals with gill raker counts of 25 are referable to the Sacramento race, we may, on the basis of our assumed dividing ordinate, analyze our Fort Bragg series as follows:

	Number of cases	Per cent
Klamath race	39	76.5
Sacramento race	12	23.5
Totals	51	100

This agrees nicely with the similar analysis of the Fort Bragg series based on the pyloric coeca counts.

In the case of the particular individuals in the Fort Bragg series having coeca counts above our dividing ordinate and suggesting that they may belong with the Sacramento race, we have subjected them to a similar test with reference to the arbitrary gill raker ordinate. Of these nine individuals five are seen to have more than 25 gill rakers, which places them with the Klamath race; the other four fall with the Sacramento series.

Again, we have compared these same individuals with reference to coeca and ova counts and find that every individual whose coeca count indicated it to be of the Sacramento race had ova counts above 5000, thus agreeing in this respect also with the Sacramento characteristics. These comparisons we tabulate below:

Collection number	Coeca	Gill rakers	Ova
1995	185 (S)	28	5450 (S)
2119	185 (S)	27	5093 (S)
1908	182 (S)	22 (S)	6851 (S)
1912	180 (S)	27	6358 (S)
1994	180 (S)	26	6309 (S)
2116	174 (S)	25 (S)	-----------
1838	161 (S)	25 (S)	9021 (S)
1992	160 (S)	26	5042 (S)
2023	155 (S)	24 (S)	8258 (S)

With regard, then, to our nine doubtful individuals, four of them (concurring nicely in ova, coeca and gill raker characters) may be placed with much confidence with the Sacramento race. This leaves a residue of only five individuals which appear not to belong with the latter race. These fish seemingly belong to a race which possesses the coeca and ova characteristics of the Sacramento salmon but have the gill raker traits of the Klamath fish.

Therefore, on the basis of this comparative analysis of the few doubtful coeca counts from Fort Bragg, we compute that approximately 82 per cent of the entire Fort Bragg series are of the Klamath race, 8 per cent are of the Sacramento race, while 10 per cent are of a doubtful source.

Vertebra Counts.

The writer has recently conducted some experiments with the use of X-rays for the vertebral examination of fishes. A report of this work, now in manuscript form, will give the details of the technique and we will merely state here that in connection with our X-ray operations we made some radiographs of Klamath River and Sacramento River king salmon. The results of these are listed below.

TABLE IX. VERTEBRA COUNTS OF KING SALMON "FRY" SECURED BY RADIOGRAPHS.

Klamath Estuary Sept. 20 1921	Fall Creek Hatchery (Klamath ova) Sept., 1922	Fall Creek Hatchery (Sacramento ova) Nov., 1919
No. 1=62+6=68 vertebrae	No. 1=61+6=67 vertebrae	No. 1=58+6=64 vertebrae
No. 2=61+6=67 vertebrae	No. 2=60+6=66 vertebrae	No. 2=56+6=62 vertebrae
No. 3=62+6=68 vertebrae	No. 3=61+6=67 vertebrae	No. 3=59+6=65 vertebrae
No. 4=62+6=68 vertebrae	No. 4=60+6=66 vertebrae	No. 4=59+6=65 vertebrae
No. 5=60+6=66 vertebrae	No. 5=60+6=66 vertebrae	No. 5=56+6=62 vertebrae
No. 6=62+6=68 vertebrae	-------------------------	No. 6=59+6=65 vertebrae
Mean, 67.5 vertebrae	Mean, 66.4 vertebrae	Mean, 63.8 vertebrae

The formula here used to express the vertebral count is applied as follows: The second value denotes the number of vertebrae involved in the caudal support; the first value denotes the number of vertebrae preceding those just described; the last value represents the total number of vertebrae (not counting the urostyle).

It will be seen that the number of vertebrae of the Klamath River race exhibits a range of from 66 to 68, with a weighted mean of 67.0. Those of the Sacramento race show a range of from 62 to 65 vertebrae with a mean of 63.8. In this case there is no overlapping of the two series, but this phenomenon might occur to some extent were we to examine a larger number of individuals.

Table X presents in condensed summary form the results of the present investigation.

TABLE X. ANATOMICAL FEATURES OF KING SALMON OF THE KLAMATH AND SACRAMENTO RACES AND OF FORT BRAGG OCEAN-CAUGHT CHINOOK.

	Klamath series		Sacramento series		Fort Bragg series	
	Range	Mean	Range	Mean	Range	Mean
Ova counts	1,718 to 4,977	3,760	4,795 to 11,012	7,453	3,147 to 9,021	4,910
Coeca counts	93 to 193	132.2	134 to 214	176.4	87 to 185	134.1
Gill raker counts	24 to 30	27.4	21 to 25	23.5	22 to 31	26.2
Vertebrae counts	66 to 68	67.0	62 to 65	63.8	----------------	---------

The foregoing presentation of the results of our studies of the ova, pyloric coeca, gill rakers, and vertebrae would appear to support the belief that the Klamath and Sacramento races of king salmon possess anatomical differences of sufficient magnitude to enable careful workers to recognize individuals of the two races. Obviously, however, before one would be in a position to eliminate with reasonable certainty all individuals of other neighboring streams, studies similar to the present investigation would need be applied to the remaining forms. As already suggested, though, it seems reasonable to suppose that the chief salmon fisheries of the California littoral are supported in large measure by the fish of the Klamath and Sacramento rivers. If this be true, our data should constitute a preliminary guide for the resolution of our ocean run fish into their two great component groups.

A SHEEP-KILLING BEAR.

By L. N. LORENZEN, Grazing Examiner.

Since the bear has been made defendant in many sheep-killing cases in northern California and several reliable mountaineers have come forth to his defense, I am going to state my side of the case and the reader may draw his own conclusion as to the innocence or guilt of the bear.

In 1918 I had an occasion to visit a sheep camp near the slides of Nelson Creek and, upon my arrival at this camp in the evening, the herder informed me that an old bear with two cubs had been following the sheep for about ten days and was killing a sheep every other evening. That evening while watching the sheep feeding into the bed ground, I happened to look up on a side hill where there were about fifty head of sheep and I saw a dark brown object charge the rear of this small band. I immediately informed the herder that his pet bear had taken another sheep, whereupon we collected all the sheep dogs and a prize hound that was kept at the camp to defend the sheep from bear, and went to the scene of the kill. Here we found fresh bear tracks and fresh blood on the ground and on the brush. We turned the dogs loose, giving the hound first place, and I expected that we would soon have the bear up a tree and completely at our mercy; but not so. The hound led out with a loud bellow and long leaps, with the other dogs in hot pursuit. Soon we heard the dogs in a free for all fight among themselves, about 150 yards up the hill, and when we got there we found that they had chased the bear away from the carcass of the sheep and had it about devoured. Here our chase ended until we could get the few remaining morsels of the sheep away from the dogs and hang them in a tree out of their reach.

After the hound had satisfied himself that there was no chance for any more mutton for supper he reluctantly took up the bear track and we could hear him bellowing on the trail for about an hour. By this time it had become so dark that further chase was impossible. The only real good with which I was able to accredit the hound, aside from eating up everything around camp, was to chase the bear far enough away that it took her two days to walk to the band of sheep, which fully explains why she killed a sheep only every other day. This is a case where I was an eye witness to the killing, and I am able to cite other instances where sheep were compelled to leave the ranges on account of bear.

I do not believe that every bear kills sheep; in fact, I feel sure that they do not, but I do think that any of them can acquire the habit with a very small amount of encouragement. Careful observation has led me to believe that in many instances the bear acquires the habit of sheep killing from the careless method of disposing of sheep which die on the ranges. These sheep and others which are sick or crippled are left behind the band for any animals that wish to prey upon them. The bear, being a scavenger, eats the dead sheep and if he finds one that is not quite dead he may kill it and thus acquire his desire to kill to satisfy his ungovernable appetite for mutton.

Whenever a bear has acquired the habit of sheep killing there is but one thing for the sheep man to do if he wishes to continue using the range, and that is to dispose of the bear. As a general rule it is not hard to distinguish a bear's kill in a band of sheep from that of coyotes or lions. The bear is a glutton and will seldom kill more than he can eat, which, as a rule, is but one sheep, while a lion or coyote will often kill as many as ten before stopping. I do not believe in taking protection away from bear but I think if the sheep men will bury all dead sheep (not burn them, because this is prohibited on account of fire danger), that the losses due to bear will be considerably less.

A SALMON'S LAMENT AT THE ESTACADA FISHWAY*

By E. A. McGregor.

Oh tell me, brother *Homo,*
What you think I'd better do;
Here I am from deep salt water
With a dress of silvery blue.

I have struggled up Columbia's
Dang'rous waters set with seines,
Dodged 'twixt salmon wheels and
gill nets—
Overtaxed my meager brains.

When I reached the broad
Willamette
Something told me to turn in,
And I swam past Portland City—
Urban sewage on my skin.

Icy waters of the Clack'mas,
Fed by sparkling mossy springs,
Aroused my latent instincts,
Formed by ancient salmon kings.

Up the stream to Estacada,
O'er many a baffling falls,
I was urged forever onward,
Onward up the cascade walls.

Ever dodging wary anglers
And evading cruel spears,
I arrive at Estacada—
Rather tatterd for my years.

Up the stream to Estacada
With my load of salmon eggs;
I would that I might shed my fins
And grow a pair of legs!

Some greedy corporation
Has built a mighty dam—
Eighty feet above the river—
For mercenary *Man.*

True enough, they built a
''fishway''
On the placid eastern side,
Fraught with crooks and bends
and zig-zags—
But they've not supplied a guide!

So here, at Estacada,
With my fifty-hundred eggs,
Alas, has Nature failed me
In my desp'rate need of legs.

A slave to instinct habit,
I must batter at the falls,
Which splash o'er rocky ledges
'Neath the massive concrete walls.

For Nature's built within me
A law both wise and rash:
You who'd gain the crest,
Leap where the waters splash.

Oh men of greed and money,
You've reared a lofty dam;
Your whirling turbines capture
All the kilowatts they can.

I would that you might ponder
On the ages that have passed;
Of our countless generations
I fear I'm near the last.

Long e'er you men of fortune
Had your ''easy-money'' dreams;
In fact, before the white man
Ever saw our western streams:

In those virgin days primeval
My silvery chinook tribe
Fairly dammed the river's current
As we swarmed from ocean tide.

My breed is doomed to perish,
Your dams obstruct my way,
Our spawning runs are baffled,
My eggs I'll never lay.

Shame, greedy men of Mammon,
Though your golden turbines turn,
You have stilled my silv'ry fam'ly
By your projects bold and stern.

Yes, I'm here at Estacada
With my fifty-hundred eggs,
After dodging seines and gill nets–
But I lack a pair of legs.

And an Alpine guide should lead
me
Up your stupid mystic route,
Which is far too steep and dizzy
For a salmon or a trout.

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*The above poem may not pass the censorship of students of English and of poetry, but the idea behind it is unmistakable. It was contributed by a scientific investigator who, fortunately, is one who has some æsthetic ideals that have not been obliterated by diligent search for fact.—Editor.

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All material for publication should be sent to H. C. Bryant, Museum of Vertebrate Zoology, Berkeley, Cal.

January 12, 1924.

Through education, law enforcement and organization, the destructive ideas of taking without returning, of destroying without restoring, of using up in the present without regard for the future, are rapidly giving place to better and more unselfish views.—A. B. Brooks.

STATE FAIR EXHIBIT.

The permanent exhibit at the State Fair was remodeled and put in shape during August and proved, as usual, a great attraction during fair week. In addition to the panorama with its changing lights, the usual exhibit of live trout was made. A splendid shipment of golden trout from the Mount Whitney region proved a short-lived attraction for continued difficulty was experienced with mineralized water. The well water used in the aquaria has usually been sufficiently pure to sustain fish life but this year many valuable fish were lost. Record should here be made of the death of a very unusual eastern brook trout with a notable color pattern. This fish, nearly 20 inches in length, was marbled over its entire surface with a pattern exactly like that on the back of an eastern brook trout. In other words the color pattern of the back extended down over the sides, displacing the usual spotting.

An interesting display of illegal nets and set-lines occupied space in the second room. On one wall hung a sturgeon set-line, the kind of line largely responsible for the depletion of this valuable food fish. Overhead hung a fyke net and on the north wall was to be seen a small silken net used by the alien violator in capturing small song-birds. The usual arrangement of enlarged photographs decorated the walls. As in the past, the educational films of the Commission were displayed twice daily in the motion picture theater. A lecturer explained the pictures and emphasized fish and game conservation.

PUBLIC SHOOTING GROUNDS—GAME REFUGE BILL.

A concerted effort is being made to gain the passage of the proposed Public Shooting Grounds—Game Refuge Bill, killed by the last Congress. With the objections of the western commissioners removed, the bill should have every chance of passage. Its greatest antagonist is no longer in Congress and additional friends are lining up for the passage of the measure. The California Fish and Game Commission has taken a definite stand in favor of the bill.

IN MEMORIAM—JOHN J. BARNETT.

As if the inexcusable number of hunting "accidents" already were not appalling enough, it remained for an unkind fate to add Deputy Fish and Game Commissioner John J. Barnett to the list early on Labor Day, when this big-hearted, faithful and fearless conservation officer was instantly killed while trailing a mule-deer near Lookout in Modoc County, where he had gone with a party of Ventura friends for his first "regular vacation" in years.

The fatal shot was fired by a close friend and county-appointee who claimed to have drawn trigger on a large deer which apparently the bullet did not strike, but found its billet in Barnett's back about 75 yards farther on. The course of the wounds indicated he had been following a fresh track and crouching to see it better in passing through the brush. As it was a soft-nosed Mauser, no deer-hunter doubts that the poor fellow was past recognizing even the nearly-crazed unfortunate who rushed up in response to his agonized cry. Such a coincidence of shooter, deer and victim in line 150 yards apart surely suggests the faith of the "Fatalists" who believe their time fixed.

"Big Jack" was buried by the Benevolent and Protective Order of Elks, in presence of his nearest associates of the Southern Division of the Fish and Game Commission, together with a host of other near and dear friends whose presence at the last tribute of respect and affection spoke more eloquently than mere words of the high regard wherein the dead officer was held by his fellow-townsmen and co-workers. His death was a personal loss to thousands of sportsmen with whom he dealt in course of conservation duty.

Pitiful and wholly regretable as must be any accident which snuffs out in his very physical prime, a magnificent specimen of muscular, upstanding manhood, six feet one-inch tall, broad shouldered, weighing 225 pounds, in condition, whose very appearance helped uphold the majesty of the law, the death of this veteran fish and game protector at least demonstrated that an honest and active warden nowadays stands better than well in his community; and that the days when conservation enforcement lacked support are now numbered in the "Dark Ages" of southern California. Would that we also might believe that this terrible and shocking accident which has torn from wild-life work one of its most experienced protectors, might help somewhat to impress upon everybody the need of more and more caution afield in this time of ever-increasing hunting enthusiasm; for such belief might hold the hope that this good and true sportsman had not died wholly in vain. But it is hardly even a hope; for calm judgment fears that the killing of men for game will go on and on, even as criminally careless starting of fires is doing. Yet, for those mentally capable of careful thought, this incident of a veteran, experienced deer hunter dying before the fire of another by no means a novice, is fraught with food for earnest consideration. It is certain that the enormous increase of hunting "accidents" is becoming one of the greatest deterrents to those who otherwise would seek out deer.

John J. Barnett.

Of the work of "Big Jack" Barnett, as he was affectionately known, volumes might be written concerning the wild-life welfare of Ventura County; he was born there, and knew his hills as few if any others now know them. In his youth a professional ballplayer of National League ability, he was an enthusiastic and true sportsman to the last, falling a victim to his disinclination to kill any but the largest, finest deer, for which he had made this last trip to northeastern California's lava beds, seeking out the biggest and best of the "muley" bucks. He protected the game in best of faith because he had the sportsman's abiding love of it; a love that has accomplished all the practical results in its behalf that this state ever has attained. In passing, it might be said that there were few hunters and shots his equal with either rifle or shotgun. To a perfect physique he added a true eye and an enormous, lifelong experience with the habits of wild game as well as the human nature of its biped enemies. Such men are rare, and becoming rarer in these days of advancing civilization; their loss is one impossible to replace. They know the game and its controlling conditions; would we had more of them.

Barnett's is a loss that can not even be written of by those who knew him, without tears. Particularly does it come home to those of us who can not bring ourselves to believe that this big, handsome fellow with his cheery smile will never again darken the office door, to brighten up the place a minute after with that breezy way so intimate a reminder of the great outdoors he loved so well and served so faithfully.

L. HEDDERLY.

ALBACORE FISHERY WORRIES CANNERYMEN.

Cannerymen of southern California were greatly disturbed during the latter part of July because of the failure of albacore to put in an appearance in their usual habitat about the Channel Islands. Five hundred fishing boats scoured the sea but failed to find fish. As a consequence the price jumped from $120, that paid last year, to $220 and even $300 per ton. Even with such prices offered, the canneries, as well as the fishermens' fleet, remained idle.

On August 1, large catches were reported in the vicinity of Todas Santos Island, off the Lower California coast. Albacore were reported as close in shore and very hungry. Although some improvement was evident later, yet the season proved a very poor one.

On August 27, near the end of the season, the Curtis Corporation of Long Beach paid fishermen $400 per ton, the highest price which has ever been paid for "white meat" albacore. Moreover, this has been the shortest season in the history of the industry. The pack this year it is estimated will amount to about 185,000 cases as compared with last year's total of 300,000 cases. Undoubtedly this scarcity will result in an increased market price for the canned product.

This decreased run of tuna adds one more problem in the investigation being made by the Fish and Game Commission to determine whether such a scarcity of fish is caused by actual depletion or by natural fluctuation.

COURT ORDERS SCREENS INSTALLED.

Because of its possible bearing on the application of the Electro-Metals Company, now pending before the Department of Public Works, Division of Water Rights, for certain water and power rights on the Klamath River, unusual interest attaches to the permanent restraining order issued by Judge C. J. Luttrell of the Superior Court of Siskiyou County, July 17th. This order, which directed the Parker Company, owners of large holdings of irrigated lands in Scott Valley, to refrain from using their canals and ditches until properly and adequately supplied with screens, upholds the right of the state to compel owners of land to install screens which will prevent the fish from being carried out onto the land. The decision is encouraging as such screening would be useless should the proposed dam be built near Orleans.

This proposed project of the Electro-Metals Company is one which challenges the interest of all California anglers since their object is the construction of a dam 250 feet high, 80 miles from the mouth of the Klamath River, the last stronghold of the king salmon, the best run of trout, and the most important source of supply of trout eggs. The attempt to preserve these great natural resources is not in any sense a move to hinder power development in California. It is stated on good authority that not only is there no immediate need for further power development on the Klamath River, but that it will be many years before such need exists.

SAVE THE KLAMATH SALMON AND TROUT.

Typical of the letters being received by the commission regarding the proposed construction by the Electro-Metals Company of a 250-foot dam 80 miles above the mouth of the Klamath River, which would form an impassable barrier to the last great run of king salmon and sea-run trout in the state, is the following from a California sportsman:

"I never enjoyed fishing any place more than on the Klamath River. The fish are too hard for the 'greenhorn' to catch. They are large and fine and good fighters, and the Klamath is a swift-running river. If the Electro-Metals Company is allowed to put in a dam at "Happy Camp" on the Klamath, the river will surely be ruined for all kinds of fishing. The run of salmon and steelhead will be shut out and the stream rendered useless for propagating these fish. This it would be a shame to allow, for California is a paradise for sportsmen and the fish and game should be preserved. The run of salmon and steelhead in the Klamath River is a great asset to California. The loss of it could never be recovered, or even repaired. Therefore, in this particular instance I believe the state can not afford to allow the construction of this dam. I am glad to know the Fish and Game Commission is trying to defeat this proposal and I certainly hope it may be prevented."—R. F. COOKE, Los Angeles, Cal.

THE ALIEN VIOLATOR AND EDUCATION.

In California the majority of violations of the game laws are credited to aliens, of whom a large proportion are Italians. It is a notable fact that they are particularly troublesome about taking all kinds of birds, the song and insectivorous species as well as the game birds and small animals taken out of season. Many nets and other illegal devices for snaring small birds have been confiscated by deputies.

These violations are better understood when it is known that Italian game laws differ radically from those of this country. It is small wonder that the Italian laborer looks upon his hunting permit as a blanket affair covering everything, when in his own country all birds, even to the smallest varieties and those of most value to agriculture, either had a long open season or no protection whatever. It is also true that most of the devices used for catching birds are permitted in Italy, even to the use of decoys in nets during daylight hours.

In view of these facts the most logical and fair remedy, it would seem, lies in a campaign of education designed to inform such violators of the differences in our game laws and to impress them with the fact that our laws will be enforced. Teach them the value of birds to agriculture, provide signs and notices printed in their own language explaining specifically what a hunting license covers and when seasons open and close. Such a campaign, thoroughly and persistently followed, may result in turning many of this class of violators into active conservationists. The cause of good citizenship will thereby be advanced also. The Commission plans to enlist Americanization agencies in such a campaign.

CONSERVATION SENTIMENT IS GROWING.

Heretofore drainage projects have been put through with no consideration being given as to the effect upon natural resources. If land could be drained and turned into farm land, it was considered sufficient cause for destroying breeding grounds of fish or game. That the time has come when the value of such areas as breeding grounds for wild life is actually considered and compared with its agricultural value is evident from recent legislation in the middle west and from the storm of protest which has arisen over the proposed Winneshiek Bottoms Drainage Project. The area proposed to be drained lies along the Mississippi River between Lake Pepin, Minnesota, and Rock Island, Illinois. The plan is to dredge and dyke the main channel of the river so that all the rest of the bottom land from bluff to bluff will be thereby made dry land and thus suitable for farming purposes.

An agricultural expert of the Iowa Experiment Station opposes the project on the grounds that it is economically unjustifiable on acount of the prohibitive cost, the small value of the farm land, the danger of overflows and the resultant destruction of the breeding places of waterfowl and fur-bearing animals, and the spawning grounds of fish, as well as the recreational features of this section.

The Isaak Walton League points out that this area is the spawning grounds for black bass and all of the warm water game and food fishes. It is called the greatest natural hatchery for game fishes in the whole world.

An investigator sent out by the United States Biological Survey reports that the whole area is an excellent resort for waterfowl of all kinds and that the muskrats are a resource of considerable value. The various lakes and sloughs form a wonderful refuge for fish and supply suitable spawning grounds. During the year 1921, the United States Bureau of Fisheries reclaimed 23,607,000 fishes from this general area. The Bureau of Fisheries which has endeavored to maintain the supply of fish in this part of the Mississippi River recognizes that all of their work would be nullified by this drainage project. Local sentiment also appears to be strongly opposed.

Secretary Hoover, when interviewed on the subject, is quoted as saying, "Until the people care and let their state governments and the national government know that they do care, it is useless to attempt to get anywhere with pollution or any outdoor American legislation."

It is certainly encouraging to see such strong opposition to a scheme which undoubtedly would seriously affect the fish and game resources of several states.

CALIFORNIA ASKED TO INTRODUCE THE AMERICAN WOODCOCK.

The Bulletin of the American Game Protective Association, through the columns of *Field and Stream*, makes the suggestion to the various game commissions of the Pacific coast that they introduce the American woodcock from eastern states, where it is still possible to secure a supply. Conditions on this coast, from British Columbia to northern California, are said to be ideal for this highly prized game bird.

Many experiments in introduction of exotic species have been tried, as for instance, that of the California quail into Chile, the importation of the Hungarian partridge into many western localities in Canada and the United States, and the popular Chinese pheasant into several states. Where such introductions do not interfere with native species, they often

FIG. 35. "I got him!" That was the exclamation heard from Mrs. John Edwin Hogg after a lone Canada "honker" winged his way over the marsh and she had fired one shot at him with a 20-gage shotgun. Photograph by John Edwin Hogg.

prove a valuable contribution to the game resources, furnishing additional sport and, in some cases, being of possible help to native species by lessening the concentration of hunting upon them.

Where, however, has a migratory shore bird been successfully introduced? This would constitute a brand new experiment and one fraught with unknown difficulties. Then too, it is well to remember in this connection that all such introductions have greatly increased the problem of game conservation and in some cases species have proved dangerous pests. In such an undertaking, western states should proceed with caution and thoroughly investigate the problem before launching such a project.

OREGON HAS NEW COMMISSION.

During June, Governor Pierce of Oregon made a complete change in the Game Commission. The Governor's statement was as follows:

"I am making a change in the game commission of Oregon because of the lack of harmony now apparent in that body and because of the strong indication of political manipulation by certain men now connected with the administration of game affairs. The future of game in the state of Oregon is far too important a matter to be handed about politically.

Three hundred thousand dollars annually as paid by the sportsmen of the state is far too large a sum to be jeopardized by disconcerted effort. The preservation of wild life of the state is the paramount consideration of the commission.

Because of these considerations I deem is advisable at this time to make changes in the personnel. The governor is responsible for the commission and therefore to the sportsmen of Oregon for the conduct of game affairs.

With the deep realization of that responsibility I have selected as new members of the commission, men of the highest type, all of them successful and responsible business men and all interested in the conduct of game affairs.

It is not the intention of the executive to dictate to the new commission or to meddle in any way with its affairs. It is not the purpose of this office, as has been suggested, to throw the commission into politics.

Game affairs are to be left entirely to the new commission, a body in which the governor has the utmost of confidence and a body which will meet its obligations with the greatest advantage to the wild life of the state."

THE CROW AND GAME.

Recent investigations by Dr. B. H. Warren along the eastern shore of Virginia has brought forth a mass of evidence showing that great damage to game results from the egg-destroying propensities of the crow. A number of islands were visited and in each instance thousands of eggs of the game and useful birds were found destroyed by crows as well as a large number of young birds. On islands where human habitations were abundant many eggs of chickens and wild ducks were found destroyed.

Dr. Warren states that on Cedar Island, where a colony of about forty crows were found, five nests were discovered. "In an hour and twenty minutes, under these five nests and within a radius of 150 yards, I found fully 2500 egg shells of the game and nongame birds which had been eaten by crows."

"At Pammer's Point there stands a large pine tree, much higher than any other tree about it. This is evidently a feeding station for crows. There were two crows' nests within a hundred or a hundred and fifty yards of this tree. One of these nests contained five young, which were of the common American crow species, and the other containing one young, vas that of the fish crow. Under the large tree referred to, near the nests, there were at least 225 empty egg shells; many egg shell fragments about the tree were not counted. This mass of egg shells consisted chiefly of those of clapper rails, green herons, laughing gulls, and a few eggs of barnyard fowls."

The islands visited are very largely owned and controlled by sportsmen's clubs and consequently the investigation should stir up interest in the control of this pest. Fortunately, in California the crow has not developed such unusual egg-eating habits, although it is well known that poultrymen in the vicinity of Petaluma sometimes are troubled by crows. Such evidence as presented by this investigation in Virginia should make California alert to examine the nests of California crows for similar evidence that we may be forewarned as to the actual effect upon other birds.

JAIL SENTENCE FOR VIOLATOR.

An item in the *Catalina Islander* of June 27, states that having been found technically guilty of violating section 636 of the Penal Code (relating to nets), Captain Nick Skomereza, owner of the commercial fishing launch, *Daylight of Seattle*, San Pedro, was sentenced to 100 days in the county jail. Captain Skomereza, who was given a suspended sentence by the court a year ago, admits that the entire catch of fish—18 tons of barracuda—said to have been illegally taken near Seal Rocks, May 7, was sold and the proceeds received by him and divided among the crew. Although it seems that the vessel left San Pedro harbor without reporting a change of officers, Captain Skomereza maintains that he was not on board the vessel when the fish were taken, and on that ground his counsel announced that the case would be appealed to the superior court. The arresting officers were unable to locate any of the fishermen who manned the boat at the time the fish were taken. Captain Nidever of the Fish and Game Commission appeared in court against the defendant.

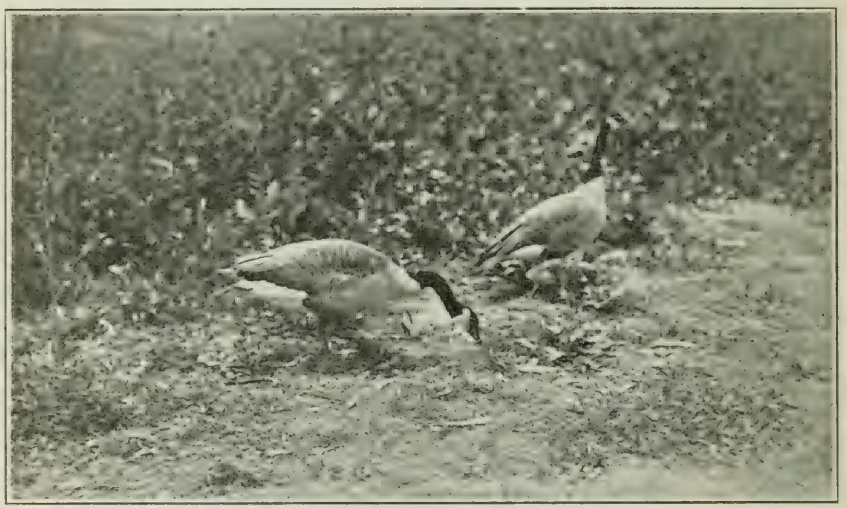

FIG. 36. Canada geese, photographed at former State Game Farm at Hayward. The Canada goose is the largest and the only species of goose which nests in California. Photograph by H. C. Bryant.

GAME LAWS FOR PLANTS.

More and more as the years go by it is becoming necessary to protect, by law, rare or much sought-after native plants and shrubs. Vermont had its problem in the collection of living plants and ferns by nurserymen for commercial sale. Connecticut has the problem of being easy of access by automobile from New York and Boston and of having its woods and hills stripped by motorists of the state flower, the mountain laurel, and of the exquisite trailing arbutus. Because of the destruction wrought upon these and other plants, statutes have been enacted to protect them. Maximum penalties range from $20 to $100 or 12 months of imprisonment, or both. Unless there is a decrease in the heedless gathering of many of our California wild flowers and shrubs, measures will have to be taken for their protection similar to those provided for the Toyon berry.

CONNECTICUT BOARD TO INVESTIGATE SHAD DEPLETION.

For an investigation into the causes of the alarming depletion of shad in the Connecticut River, the legislature of that state has appropriated $10,000. The investigation will be conducted during the summers of 1923 and 1924 under the direction of the Connecticut State Board of Fisheries and Game and a staff of six eminent biologists, including Dr. J. E. Blair of Stanford University, has been engaged for the work.

The shad, a popular fish in eastern markets, has decreased very rapidly since 1919 as evidenced by the decreasing commercial catch and the increasing difficulty of obtaining eggs for artificial propagation. The experiments being undertaken. will cover studies in methods of catching the fish for artificial spawning; life history of the shad including food habits, migration periods, and other phases; various problems of pathology such as parasitism and enemies of larval and young shad; a close observation of ecological conditions, especially the pollution of tributary streams in which the shad spawn; tagging experiments of adults to obtain information on successive migrations and the feasibility of providing greater security to young shad by holding in specially prepared ponds a part of the artificially hatched fish.

The shad was the first species of fish introduced into California by the Fish and Game Commission (plantings were made in 1871 and 1873) and it became very abundant here. While shad have increased enormously in California, the supply has been greatly depleted along the Atlantic coast. In 1916, Connecticut and Massachusetts sought to obtain shad eggs from the California Commission for their hatcheries in order that they might restock their waters. The California Commission undertook to furnish the desired eggs, expecting to gather them in connection with an investigation of the spawning places of shad and experiments in shad culture. However, the season proved to be such an unfavorable one that it was impossible to gather enough eggs at any one time for shipment east. They did succeed in collecting enough eggs to hatch 872,000 fry which were planted in the Feather River with good results.

WILL ATTEMPT DOMESTICATION OF WILD TURKEY.

Live specimens of the beautiful Honduras spotted turkey, a fine upland game bird, native to a section of Yucatan, Honduras and Gautemala, is the object of an expedition by the Biological Survey of the Department of Agriculture to Central America. According to an editorial note in *Forest and Stream*, June, 1923, the survey intends to undertake experiments in propagating and domesticating these turkeys on an island off the coast of Georgia. The domestication of this species, which is somewhat smaller than our own domesticated turkey, has never been attempted.

THE NATION'S GAME SUPPLY.

Attention is directed to the enormous value of the nation's game supply by the American Game Protective Association. Although monetary values do not compare with the benefits yielded in pleasure, health, personal physical and mental development, self-reliance and skill in the use of firearms, all of which accompany hunting, yet the "dollars and cents" value to hunters is worth consideration. Dr. E. W. Nelson, chief of the United States Bureau of Biological Survey, is quoted from an article in the *Scientific Monthly* as estimating the game of the country, capitalized on a 6 per cent basis, as amounting to $1,000,000,000. Since the licensed and private hunters in the United States are estimated to number about 7,000,000, this would give each sportsman a share in the capital investment of nearly $150. Thus, says Dr. Nelson, "The conservation of wild animals and birds is not a mere fad, indulged in by those who have only a sentimental interest in the subject."

CONSERVING THE FUR SUPPLY.

Resolutions were drawn up at the recent International Fur Convention and Exposition at New York, recommending, for the first time in the history of the fur trade, the formation of a national organization which should hold a yearly convention in that city. The Biological Survey of the United States Department of Agriculture has been greatly interested in the fur industry from the standpoint of the conservation of wild life, and F. G. Ashbrook, one of its representatives, addressed the convention on the work of the Survey relating to fur-bearing animals.

"The fur industry," said Mr. Ashbrook, "employs many thousands of men and women who make their living from furs and who in turn contribute to the comfort of a vast number of people. Ever since the world began people have worn furs and they will probably continue to do so indefinitely. The sources of supply of fur-bearing animals should be assured, however, if the fur trade is to maintain its position among other large industries. We do not need more laws but we need better laws and a stricter enforcement of them.

"The Biological Survey believes that fur farming should be encouraged. At present the majority of fur farmers are raising silver foxes. There are at least 15,000 silver foxes in captivity and the investment in the business exceeds $8,000,000.

"The bureau also believes that to aid conservation, areas which have been depleted of fur bearers should be closed completely for several years, and should be restocked, just as public and private waters are stocked with fish, or game preserves with game.

"Fur laws should be made uniform in all states where similar climatic conditions prevail. Regulation by law of the open season and intelligent trapping should help materially to insure the source and continued supply of fur bearers. Legislation should also require that figures be furnished to show the numbers of the various pelts taken annually in different states."

The fur exposition, which was held in Madison Square Garden, was staged in an arctic setting composed of igloos, totem poles, snow and icebergs. Living models were posed to show the fur costumes of fourteen different periods in the world's history. Processes in preparing furs and making them up into garments were shown, and a style show was staged. The exposition was open only to those engaged in the fur trade, but there was a strong sentiment on the part of those in charge that another time it should be open to the general public.

WOOD DUCK HUNTING PROHIBITED.

Wood ducks may not be hunted in Minnesota or in any other state at any season, according to the Biological Survey, United States Department of Agriculture, which administers the migratory-bird treaty act. This is a federal law under which the hunting, killing, or possessing of wood ducks is prohibited at all times throughout the United States and by treaty throughout Canada also. This game law, having been upheld by the

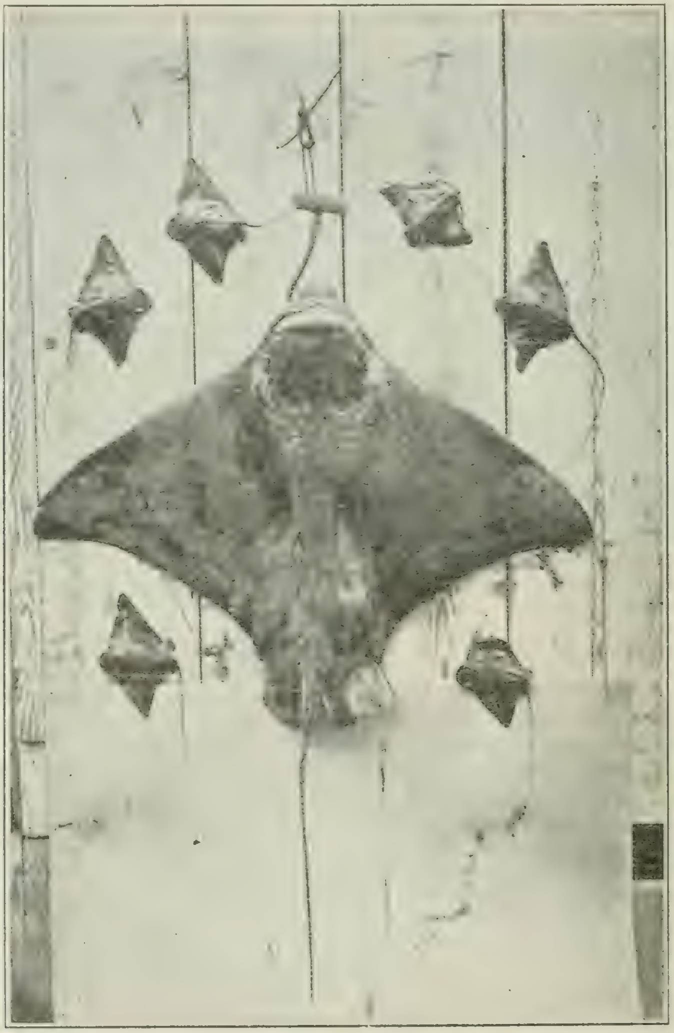

FIG. 37. Sting ray, taken by G. A. Clark in Elkhorn Slough, summer, 1920. It weighed 64 pounds and gave birth to seven young soon after capture. Photograph by G. A. Clark.

United States Supreme Court, makes inoperative the amendment to the game laws of Minnesota, passed at the last session of the state legislature, providing an open season on wood ducks. Thus, hunters will not be allowed to exercise the privilege accorded them by the state law, and persons found hunting, killing, or possessing wood ducks at any time, will be subject to prosecution in the federal courts.

HUMAN CARELESSNESS EXACTS HEAVY FOREST FIRE TOLL.

Over 70 per cent of the 610 fires that have occurred up to August 20 this year in the National Forests of California were man-caused, according to the United States Forest Service. These fires burned over 72,000 acres of government land, and 34,000 acres of private property within and adjacent to the federal forests. Out of a total of 124 fires in the Angeles, Santa Barbara and Cleveland national forests of southern California, all but six were due to human carelessness, largely that of smokers, campers and sportsmen. Fires on the Santa Barbara National Forest, set by the carelessness of campers and by incendiaries, have burned over 60,000 acres of chaparral and timber-covered mountain slopes which were of inestimable value for watershed protection purposes. Seventy-four convictions for carelessness with fire in the woods have been secured by the Forest Service to date; the fines ranging from $50 to $500, with jail sentences in some of the more flagrant cases.

Think of what such carelessness means to fish and game!

SIGNS AND SIMPLETONS.

By Ranger Bill, U. S. Forest Service.

"Did you ever notice how many people there are who seem to have a weak cog somewheres in their make-up?" said Ranger Bill as he threw a bunch of new enamel signs that had been shot full of holes into the woodshed. "Mind you I don't claim such folks are what you would call 'foolish,' but they sure must lack good sense to pull some of the tricks they do. Of course sometimes it's due to thoughtlessness, but pure cussedness would be more like it, I reckon, in a good many cases.

"Who'm I alluding to? Why, just them folks, big and small, that go around shooting up signs and writing their names on rocks and trees and buildings and any old handy place. We get a lot of them up here on the National Forests in the summer time—natives and city people and 'dudes' out on a vacation, who either think it's smart to make a pepper box out of a sign or else want to leave a monument to themselves by scribbling all over the landscape. You know that old saying about 'Fools names * * * '?

"You think I'm putting it too strong? Well I don't. If you could trade places with me for a season and see some of the stunts of these vandals, you'd know why I get hot under the Stetson. Let's look at this business with common sense. Here's the Forest Service and the automobile associations of the state spending a lot of good money each year to put up fine enamel signs so that our own folks and all the people who visit California can tour around in the mountains without getting lost. Then along comes some smart Aleck with a gun and—Bang! Bang!—another sign is shot full of holes and ready for the ash heap. And it isn't only one, but thousands of them that get made into a sieve that-a-way. Seems like these fellows would appreciate rather than depreciate a sign, and think a bit about the people that's coming after. Every time a sign is badly defaced a new one has to be made and pūt up, and that means more money and work. Once in a while we catch these birds, and the way the Judge usually hands it to them sure does a man's heart good. If there is anyone that ought to get it, and get it good, it's these sign poachers.

"Now look at those autograph sharks and some of their artistic work. Why, only last week I found the name of a professor of one of our big state universities scribbled over the newly painted door of a lookout station up at 10,000 feet. What do you suppose his idea was? If he wanted me to know he'd called why didn't he leave a card or write on a piece of paper? If I can tie-in with him I'm sure going to make him back-track up there and scrub that name off with sapolio. Just you stop and take a peek at that big Forest Service sign down at the forks of the road. I only put it up this spring, and now you'll find a regular telephone directory scratched all over its face. No, sir, it ain't th' kids that pull all this stuff, but real grown-up men and women who ought to know enough to respect other people's property.

"A fellow was telling me the other day that the temples in Egypt have all kinds of names and pictures that senseless people scratched on the stones three or four thousand years ago. I always thought we'd kind of advanced in civilization since then, but it 'pears like we've got simpletons in these days same as they had back in King Tut's time."

FACTS OF CURRENT INTEREST.

A 22-inch Loch Leven trout was caught from the Sentinel Bridge in Yosemite Village on June 29th and was on exhibition during that day in the office of the park superintendent. The Loch Leven is one of the introduced fish which, like the brown and eastern brook trout, thrives in the warmer, slower-moving waters of the lower elevations, whereas the native rainbow chooses the rushing mountain streams of a granite-walled canyon.

* * *

The season of 1923 was the greatest in the history of the Hatchery Department, the largest number of trout being planted in the history of the Commission. The total approximated 31,470,000.

* * *

The salmon season has been a poor one, the catch indicating depletion. The take will probably amount to less than half of that for 1919. Reduced catches have been made yearly.

* * *

The sardine industry has recuperated and the catch will be close to normal.

* * *

Hunting accidents have again been numerous, one of them claiming an efficient deputy of the Commission.

* * *

The duck season opened auspiciously on October 1st with birds abundant and many hunters in the field.

* * *

The Fish and Game Commission is actively fighting the proposal to build a 250-foot dam near the mouth of the Klamath River. To win the fight means the saving of the last good run of king salmon and of sea-run trout in the state.

* * *

Concentrated hunting of mule deer in Modoc County was again reported during the deer season. Sentiment favors increased protection for the large deer of the northeastern section of the state.

HATCHERY NOTES.

W. H. SHEBLEY, Editor.

TROUT EGGS TO BE IMPORTED.

Arrangements are again being made this year to trade the New Jersey Fish and Game Commission 1,000,000 Loch Leven trout eggs for 1,000,000 eastern brook trout eggs. This arrangement, made last year, was instrumental in furnishing our streams with a splendid supply of pure stock eastern brook directly from eastern streams.

ATTEMPTS MADE TO SECURE NEW TROUT.

An attempt is being made to secure a supply of Sunapee trout from the Massachusetts Fish and Game Commission. The Sunapee trout is a bright colored trout originally found only in Sunapee Lake, New Hampshire and Flood Pond, near Ellsworth, Maine. Due to fishcultural operations, however, it has been introduced into a number of other lakes. In its native habitat it does not take the fly readily but makes up for this disadvantage by its gaminess when caught by trolling. Fish have keen known to weigh as high as 15 to 20 pounds. It is also said to be especially hardy and easy to propagate.

ELECTRIC FISH STOP DOES NOT STOP FISH.

There has been a great deal of discussion as to the efficacy of electric fish screens in keeping fish out of irrigation ditches. The installation, on the Alta Canal near Dinuba, Fresno County, of an improved type of electric screen patented by Mr. H. T. Burkey, has afforded the first opportunity in California to test its real value. The report of Deputy E. W. Smalley, recently submitted, gives the results of observations made by himself and others on the Alta system below the electric stop at Wah-to-ka Lake, covering a period of three months and ranging from the stop at the lake to points south and west of Traver and to points south and east of Orosi.

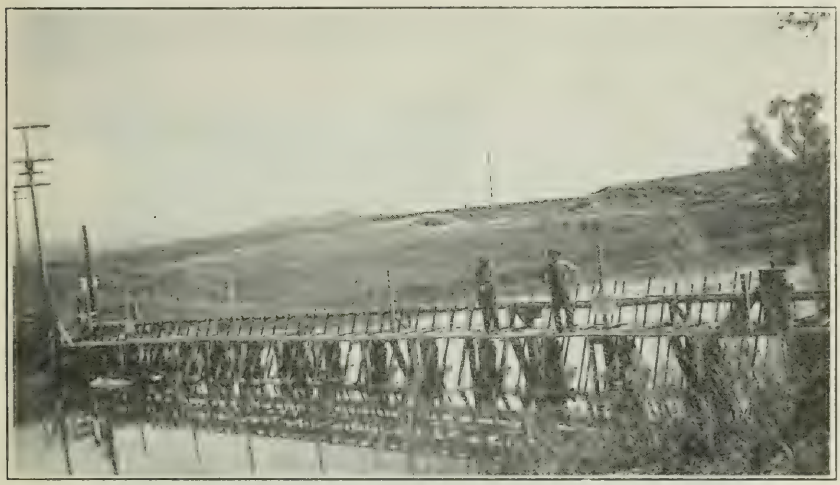

FIG. 38. Electric fish stop installed in Alta ditch near Dinuba. Investigations showed that this electrical apparatus did not successfully screen the fish from the ditch. Photograph by A. E. Culver.

It appears that early in the season (April 20th to about the middle of June), owing to high waters and the amount of water going through the electric fish stop, it was almost impossible to get definite evidence of fish life. However, observations made on June 21st, which very nearly covered the Alta system, showed several thousand small fish including bass, pike, suckers and river herring in a lateral south of Traver, and numbers ranging from a few to several hundred of these same varieties were found in various checks around Dinuba and Momson. On this date also, a carp about 15 inches in length was seen to go through the stop. About 5 feet below the stop it came to the surface, apparently injured, but less than

100 feet below the stop it was seen to swim away and seemed to have entirely recovered from the shock. By July 8th many small fish were found in a number of the extreme lower laterals of the Alta system south of Traver and Dinuba. The last observation was made on July 18th and up to that time evidence of fish life had been found in nearly every place investigated and hundreds of small dead fish were found at the abutments of the screen and many larger ones ranging from 6 to 16 inches, of the several species mentioned, were found just below the screen. Many of the dead fish found a quarter of a mile down the ditch from the screen, showed injuries from contact with the electrodes. Late in the season, bass ranging from 8 to 12 inches long were seen below the check at the head of the Reedley Canal and one 18 inches long was taken in a seine with a number of smaller ones. Bass were also seen at the head of the Traver Canal and a great many in the branch south of the Dinuba Kingsburg Highway. The accompanying photograph of a bass taken below the fish stop is evidence of the size of fish which can successfully pass this electric stop.

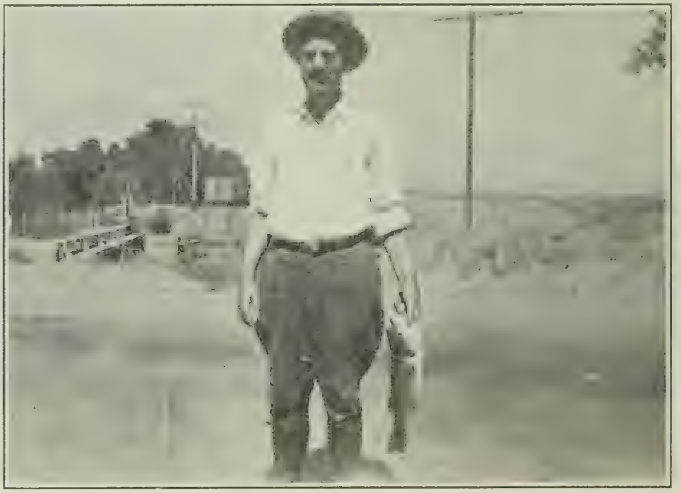

Fig. 39. Large black bass taken below electric fish stop in Alta ditch, along with other specimens, showing that this electric fish stop is not effectively screening the ditch. Photograph by A. E. Culver.

FISH PLANTED BY THE COMMISSION FURNISH SPORT IN NATIONAL PARKS.

Bulletins of the National Park Service report that fishing in the streams of Yosemite and Sequoia national parks has been unusually good this season. The Merced River is said to have furnished better fishing this year than ever before and skilled anglers were successful in taking large fish.

In June the Commission planted 95,000 rainbow trout, received from the Hammond Hatchery, in various streams of Sequoia Park and in July, 90,000 steelhead trout arrived and were planted in Marble Fork, Paradise and Deer creeks. Fifty thousand trout fry were also planted in streams within General Grant National Park. Yosemite's first shipment of eastern brook and rainbow trout numbered 200,000.

TROUT EGGS HATCHED IN GRAVEL.

The new method of hatching trout and salmon eggs in gravel seems to promise advantages of plantings in the headwaters of streams and the tributaries of lakes inaccessible with fry or fingerlings, of making distributions over greater water areas and so of materially reducing hatchery expenses and distribution costs. In the U. S. Bureau of Fisheries document, "Propagation and Distribution of food fishes, 1922," Glenn C. Leach, of the Division of Fishculture, reports the general results of experiments conducted by various stations of the Bureau in which the eggs were placed in gravel in hatching troughs, in open-air rearing ponds and in creek beds. In cases where the eggs were protected from frost and where there was a good circulation of water, good hatches were secured in nearly every instance.

Since the gravel beds of gently flowing streams and places where seepage or substream flow is present, are the spawning places naturally sought by trout and salmon, it is not surprising that practically perfect results are secured under such conditions and that the fry so hatched are exceptionally vigorous and fitted to survive.

It can not be expected that this method will prove of great value in hatchery operations in general, especially on a large scale, but its value in stocking suitable waters with eyed eggs may supplant the planting of fry and fingerlings in such places.

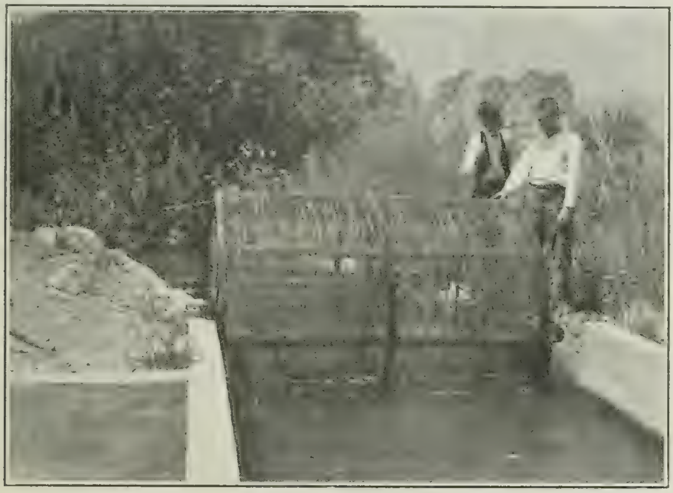

FIG. 40. Type of screen being installed by the Los Angeles Aqueduct at Fish Springs, Inyo County. Photograph by A. E. Culver.

A successful planting by this method was made in Yosemite this past summer. A shipment of eggs from the United States Bureau of Fisheries hatchery in Yellowstone National Park was planted in the stream near Ottoway Lake. Later investigation by Ranger Skelton showed a large percentage of eggs hatched. Plenty of egg shells and some newly hatched fry were found.

WHAT PERCENTAGE OF TROUT REACH MATURITY?

An experiment with trout fry and fingerling to determine two much mooted questions among fishculturists is in progress under the direction of Mr. Robert L. Ripple, Superintendent of the State Fish Hatchery at Bayfield, Wisconsin. Reliable data on what percentage of planted trout reach maturity, whether it is better to plant fry or fingerlings, and what is a good average growth in cultivated water is the object in view. The experiments are being conducted in a large pond in which conditions affecting trout approximate those of a stream, and where an absolute check on the trout planted can be obtained. In the fall of 1921 there were planted in this pond 2000 small fingerlings. At the end of a year, the pond was drained and the yearling trout were carefully counted. A total of 1321 trout averaging seven and one-half inches in length had survived. The minimum and maximum lengths were six and nine inches respectively. This season the experiment is to be repeated with the substitution of fry for the fingerlings. The results will be awaited with interest as an aid in solving some hitherto unsolved problems of fishculture.

FISH DISTRIBUTION, 1923.

Previous to September 28, the Fish and Game Commission had planted in the various streams of the state approximately 9,983,000 rainbow trout fry, 5,300,000 Loch Leven, 8,667,000 steelhead, 3,480,000 eastern brook, 1,325,000 brown, 2,530,000 large lake, 95,000 cutthroat, 90,000 Mackinaw, and some 500,000 fry yet remained to be planted.

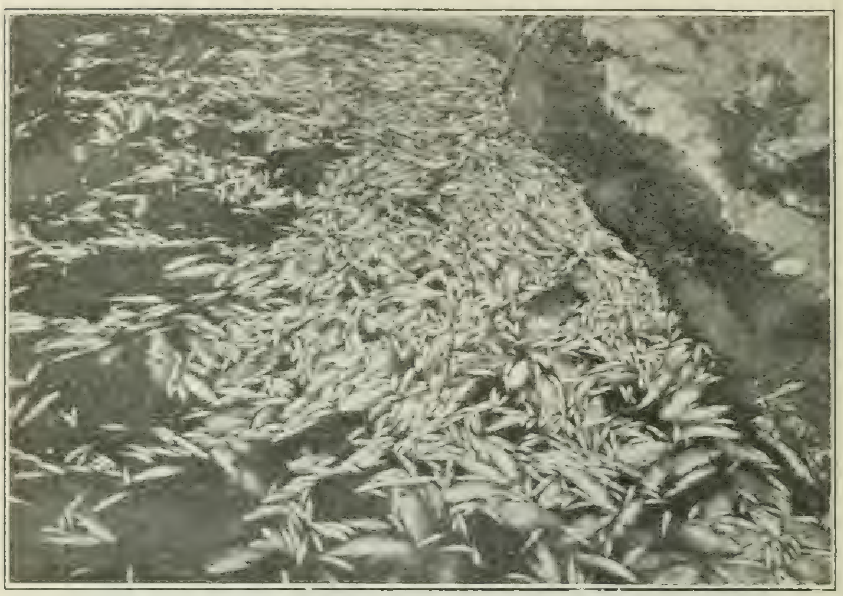

FIG. 41. Typical of what happens when an irrigation ditch is not successfully screened. More than 2100 sunfish are shown in the picture. This death toll was due to ineffective screening in Butte County. Photograph by A. E. Culver.

COMMERCIAL FISHERY NOTES.

N. B. SCOFIELD, Editor.

WHO ARE THE CONSERVATIONISTS?

It seems to be the general impression among sportsmen that if the fish are to be saved from extermination by the commercial interests the sportsmen are the ones who will have to act. Their idea of conservation it appears is not to curb in any way the sportsmen themselves but to curb only those who catch and deal in fish as a livelihood. If we examine our laws which have been passed for the purpose of conserving our food fish it will be found that the sportsmen in nearly every instance have been specially favored. A good many kinds of fish have been taken off the commercial list and their sale prohibited. They may be taken only by angling and in several instances the angler is not restricted by a bag limit. If a closed season is established for the protection of an important food fish the sportsman is given the special privilege of fishing through the closed season.

Those who have had experience in enforcing fish and game laws know that the only way to make a closed season really effective is to prohibit the possession of the fish, bird or other animal during the season it is to be protected. The three salmon or five striped bass of any size which may be taken by any one for sport each day during the closed seasons for these fish make it difficult and in some instances well nigh impossible to enforce the ban against commercial fishing during the closed time or to enforce the law against the sale of striped bass under three pounds in weight. Other special privileges which sportsmen anglers enjoy are the areas and districts which are set aside for angling and closed to commercial fishing. When these closed areas are set down within a rich commercial fishing district such as the closed area at Catalina Island and the space of 750 feet about pleasure piers, jetties and breakwaters it not only makes the fisheries patrol by the Fish and Game Commission very difficult but it tends to keep alive the antagonism which usually exists between sport and commercial interests. Most of this antagonism is the result of sportsman-made laws and the lack of knowledge on the part of the sportsmen of the commercial fishing methods and conditions. Certainly one can not attend several sessions of the state legislature and observe the passage or defeat of fish and game conservation measures and believe that sportsmen hold any monopoly on the desire for fish and game conservation.

Take for example the last session of the legislature. In the measures introduced or proposed there was ever present, on the part of sportsmen, the tendency to loosen up on the conservation laws where their pleasure was concerned. The greatly increased drain on our trout and our deer, caused by the building of good roads and the universal use of the automobile, make it advisable to cut down on the trout seasons and on the bag limits for both trout and deer. It is also urgent that the winter fishing for steelhead be stopped, for good trout fishing in our coast streams is largely dependent on preserving the large spawning steelheads. What was done? The sportsmen would not be satisfied with one buck a season, they wanted their two. The anglers did not want trout fishing restricted. Instead they wanted the daily bag limit increased and they did get the limit raised to thirty-five per day, but fortunately the bill was not signed. There was little chance to get winter steelhead fishing stopped. The tendency to loosen upon the game laws reached its climax in the serious proposal to permit the limited killing of mountain sheep by those who would be willing and able to pay a large fee. This proposal developed considerable opposition and the bill was not pushed. Such a bill has been up before and will come up again but will be defeated, more because it will be giving a special privilege to a few than because it is likely to exterminate the small remnant of our once abundant mountain sheep.

Legislation.

How did the commercial fishing measures fare? There were only two measures of prime importance from the standpoint of conservation. One was a measure which would prohibit the use of drag nets in southern California waters. It was believed the fishery would produce more if the drag net, which is very destructive to young halibut, was eliminated. The other was a measure which would give additional protection to salmon, shad and striped bass.

These measures were supported by most of the commercial fishing interests affected in spite of the fact that it meant a financial loss to them. They are for conservation for they have money invested in their business and they want their business to be permanent and continuous. It is necessary, of course, to convince the commercial fisherman or dealer that a species of fish needs protection or that the measures proposed for its protection are equitable and necessary. In the above instances this was not hard to do, except in the case of the striped bass. The evidences of overfishing are not as plain in the case of the striped bass as in that of the halibut, shad and salmon. Most of the angling clubs in the San Francisco bay and river regions believed that the striped bass needed radical restrictive measures passed for their protection. None of the measures proposed by them would restrict the angler in any way but most of the bills introduced would prohibit the use of nets for a period of five years. Such a measure was not necessary even if it could be put into practice. Due to a lack of knowledge of the fisheries, sportsmen could not see that if netting for striped bass were stopped that netting for salmon and shad in the same waters must stop at the same time. At first the radicals would not compromise but left the Fish and Game Commission, the California Fish, Game and Forest Protective League and the representatives of the commercial interests to work out measures which they considered equitable, less radical and in a large measure adequate. The measures thus adopted were finally passed by the legislature. The measures did not become effective in their entirety for the reason that the Governor failed to sign the bill which amended the law relating to the fish and game districts of the state. The principal reason for the failure of this bill was that it had many changes in the districts to please the sportsmen of local communities which were objectionable to sportsmen in other parts of the state.

Due to the failure of the "District Bill" to pass, netting was not stopped in the Sacramento River between Sacramento and Colusa, as intended, but netting was stopped above Colusa which is a very great protection to salmon as it eliminates the bar seining which was so destructive to the salmon which are virtually on their spawning grounds. The Sacramento River was closed to salmon netting during the months of June and July and the summer closed time for shad and striped bass begins now fifteen days earlier. Sea trolling for salmon is materially restricted. The seasons for salmon sea trolling in northern California waters are not what was agreed upon, due to the failure of the districting bill to become a law, but the salmon will not suffer on account of it.

The bill which prohibited the use of drag nets in southern California waters was passed and received the signature of the Governor. Due to the failure of the districting bill, the prohibition against drag nets applies to Santa Barbara County waters as was not the intention. An attempt is being made to remedy this by test cases in court.

The important conservation measures passed at the last session of the legislature were commercial fisheries measures and they were passed with the aid of the commercial fisheries interests. On the sport side of the ledger there were no conservation measures of importance passed and the important measures which were proposed, failed to pass for the reason that they were opposed by sportsmen.

Another bill which failed to meet with the approval of the Governor was one which would have permitted any reduction plant to use sardines without limit as to amount during four months of the year. This bill was originally introduced at the request of sardine canners who would reduce the amount of sardines a canner would be allowed to use for reduction purposes. At the request of the Fish and Game Commission changes were made in the bill so as to make the law easier of enforcement. When the bill came up in committee those who were anxious to obtain more and cheaper fish meal for poultry feed and fertilizer, those interested in reduction plants and machinery, as well as sardine canners who would make a profit on the side by means of their reduction plant, succeeded in getting the bill amended so that its meaning was quite different from what was originally intended. Many ingenious arguments were brought out in the talks before the committees. The best points brought out by those who would use sardines for reduction purposes were:

Sardines on the coast of California are very plentiful and in spite of the large catch of the past few years are more abundant now than they were ever known to be. It has never been proven that members of the herring family, to which the sardine belongs, have ever been exhausted at any place by overfishing. If there is any danger of overfishing here in California, the investigations being carried on by the Fish and Game Commission will show when they are being subjected to too great a strain and the fishing for reduction purposes can be restricted or stopped.

The better arguments in opposition were:

While there have been periods of scarcity in the past and sardines are apparently more plentiful now than for several years past, that is no sign they will continue to be abundant. Fish like the sardine are subject to great natural fluctuations in abundance and they probably will become as scarce again as they were in 1913, even if they are not subjected to heavy fishing. Any fishery can be depleted if great quantities of the fish are caught. If the menhaden, which is caught on our Atlantic coast in quantities as high as six hundred million pounds a year, does not show depletion, it is because no system of records or of investigations have been carried out which would show depletion, if it were occurring. Even if our sardine can stand much heavier fishing than it is being subjected to now, there is danger that a great reduction industry will gain a foothold which can not be shaken loose when depletion is shown, and our sardine industry, which should be of the most value because per ton of fish it would give employment to more people and the finished product would be of greater value, would be jeopardized. The arguments in favor of using them for reduction until depletion can be shown, won out with the legislature but they did not win out with the Governor.

The most interesting contest over fisheries legislation was that which arose over the bill of Senator Sample of San Diego which prohibited the use of purse seines for barracuda, mackerel or any small fish, for it did not permit a purse seine to be used with meshes measuring less than four inches. The bill also prohibited the catching of barracuda with lampara or round-haul nets. The bill was introduced at the request of the organization of fishermen of San Diego who are principally gill-net fishermen and who are opposed most strongly by the purse seine and lampara fishermen and by the wholesale fish dealers of San Pedro.

The Fish and Game Commission knowing of the growing opposition to the nets which have been recently introduced and which have interfered economically with the gill net fishermen, employed Tage Skogsberg, a competent investigator, then on its staff, to make as thorough an investigation as was possible during the season prior to the meeting of the legislature. His conclusion was that there were no data to show that the use of purse and round-haul nets was depleting the barracuda as claimed. (See CALIFORNIA FISH AND GAME, July, 1923, p. 87.)

If it was a question of conserving the barracuda a short closed season during the time they were schooling in April and May, preparatory to spawning, would be sufficient. The fresh fish markets he found were dependent on these nets for their winter supply of fish and he recommended that no radical legislation be passed, such as limiting the size of mesh of the purse seine, for that would result in putting purse seiners out of business. He recommended that an investigation be undertaken on the barracuda similar to those being carried out on the albacore and sardine, in order that depletion may be detected in time to prevent serious results. Mr. Skogsberg's report was the only real evidence presented in the discussion, but it was not sufficient to prevent the passage of the bill. It was sufficient, however, to convince the Governor and the bill was not signed.

THE LAMPARA NET.

Whenever a new and improved type of fishing gear is introduced and it upsets the old economic order, there is immediate opposition. This opposition almost always has used the argument that the new type of net is destructive to young fish and to the spawn of the fish, or that it wastes the mature fish by making catches which glut the market and waste results on that account. The introduction of beam trawling in the North Sea and later the larger otter trawl brought on a bitter fight against their use by the inshore fishermen and lasted for many years. The disputes were the subject of several investigations by different boards appointed in England and Scotland and in some of the other countries bordering the North Sea.

At first, restrictive legislation was adopted which, in the light of later information it was deemed best to remove or modify. In our own state the first use of paranzella nets or trawls by steam tugs outside of San Francisco harbor brought forth protests from the other fishermen. The introduction of the lampara net in the sardine fishery at Monterey met with the same kind of opposition and at the 1913 session of our legislature was near to being outlawed. Yet it would be hard to devise a net which would cause less undue destruction of fish. If the legislation had been passed by the legislature of 1913 it would have been a serious blow to the future of the sardine industry for the present huge proportions of our sardine industry has been made possible largely by the introduction of the lampara net.

PROTECTION OF SALMON ESSENTIAL.

We have had a great many complaints about the salmon season closing too early at this place and that place, that fishermen were no longer able to make a living fishing for salmon and that there should be a longer open season at various places in California.

Permit us at this time to say to the fisherman, that we truthfully feel sorry for him. For the following shows the writing on the wall. The catch of salmon in California in 1919 was 13,145,728 pounds; 1920 was 11,133,819 pounds; 1921 was 7,990,932 pounds, and 1922 was 7,235,124 pounds. The catch for 1923 has not been completed but we are sure it will be far less than that of 1922.

Something had to be done in order that salmon would not become extinct. Power dams being constructed on rivers frequented by salmon, intense fishing for salmon in ocean waters, as well as in the rivers, made it necessary to shorten the time that salmon could be caught commercially.

The catch at Monterey Bay, including Santa Cruz, was almost a complete failure this year, although the catch in the ocean waters outside of San Francisco was fair, it will not come up to the catch of 1922.

At Noyo, near Fort Bragg, which is a very busy salmon fishing center, it was necessary for the plants at this point to close down much earlier this year than in former years, due to a very bad entrance to Noyo River and also due to a scarcity of fish. These plants closed the latter part of July, while in former years they ran during the month of September.

At Shelter Cove there was a good run of large fish the middle of July and this run continued until the close of the season, August 15th.

Off Eureka there was a good run of salmon until the latter part of July, after this date fairly good catches of salmon were made off Trinidad. These fish were picked up by buyer boats from the various fish companies and taken to Eureka.

On the Klamath River, at Requa, the run of salmon was very late and during the latter part of July and the first part of August, practically no fish were caught. The catch for the season will be far less than that of 1922.—E. D.

THE SARDINE SEASON AT MONTEREY.

The sardine canning season this year at Monterey started in May, a month earlier than usual and promises to surpass any season since the war. Following the war there was a decided slump (1921) in the amount of sardines taken with a partial recovery in 1922 and the 1923 figures will probably show a complete recovery and the business running again on a normal basis. Sardine fishing at Monterey is conducted during ten months of the year, April and May being the off months. The figures published by the Fish and Game Commission show the catch summarized by calendar years and the cannery operators figure their seasons from January 1, to December 31, but as the canneries are closed down during part of the spring months it is, in some ways, more logical to figure the total catch by fishing seasons rather than calendar years. In the following table the total sardine catch of Monterey County is shown by fishing seasons, that is from May 1, of one year, to April 30, of the following calendar year. For simplicity, the figures have been rounded off to the nearest million pounds:

1916-1917	15,000,000 lbs.
1917-1918	46,000,000 lbs.
1918-1919	72,000,000 lbs.
1919-1920	86,000,000 lbs.
1920-1921	50,000,000 lbs.
1921-1922	33,000,000 lbs.
1922-1923	58,000,000 lbs.

These figures show the rapid increase in catch during the war, with the drop in 1920-21. The financial slump hit the cannery business a little later than in most other industries over the country as a whole and is reflected in the small take of 1921-22. Last fishing season (1922-23) shows an upward trend. This present season has started with most encouraging prospects as the demand for our coast sardines seems to be much stronger than during the past three seasons.

At present, seven of the Monterey packing plants are operating and employing about 25 fishing crews. The K. Hovden Company has purchased the nearby plant, formerly known as the Great Western, and will operate it as the K. Hovden Plant No. 2. The Carmel Canning Company has made extensive improvements, including a new building that nearly doubles their floor space and the addition of a reduction plant for offal. One innovation at this plant is interesting all plant managers who have had trouble with seaweed and debris clogging the intake pipes of their water supply. A well was sunk in the rock under the cannery with a horizontal drift just under the water of the bay. The roof of the drift was then shot out so that loose rock filled in, thus allowing an abundant supply of seawater to flow in after straining through the broken rock. The results are highly satisfactory.—W. L. S.

SARDINE FISHERMEN'S STRIKE AT MONTEREY, AND SETTLEMENT.

The sardine fishermen at Monterey were on a strike from September 17th to 24th. During this time 250 fishermen and several hundred cannery helpers were tied up. The main reason for the strike was dissatisfaction on the part of fishermen as to the two different prices paid for the sardines, those used for canning, and sardines used for reduction purposes. The fishermen felt that they did not always get paid for the full amount of fish delivered and that they had no way of checking whether the fish were used for reduction purposes, or for canning.

The question of weights was settled by calling in the State and County Sealer of Weights and Measures. As a result the canners were ordered to install uniform measuring buckets, and the round metal bucket, such as the one used by the K. Hovden plant, was agreed upon as the standard. All plants operating at Monterey have installed this uniform measure.

At first there was a deadlock in the negotiations on the question of a uniform price of $10 per ton for the fish. Representatives of both sides of the controversy were induced to meet with representatives of the Monterey Chamber of Commerce, and finally reached an agreement on the following basis:

Price to be $10 per ton for all sardines.

No crew to fish for a limit of less than ten tons.

The crews fishing at present are considered sufficient for the plants now operating, no new crews to be taken on.

Number of crews per plant to be determined by plant capacity and a twelve-ton limit per boat.

Payment for fish delivered over the limit (when a limit is set) to go to the Fishermen's organization, and not to the individual fishermen.

No donations of fish to the canner allowed.

The crew to be fined $500 for each donation proven.

Canner to deal only with the Fishermen's organization and not with individual crew captains.

Canner to order before 4 o'clock p.m. from the Fishermen's organization the lump tonnage he desires the following day.

The Fishermen's organization sets individual boat limits and the number of crews (if necessary) to comply with the canner's order for that day.

All deliveries to be measured in the standard metal bucket.

Crew captains (possibly the individual fishermen) will be paid by the organization and not by the canner, on the basis of tonnage shown by the official receipts of the State Fish and Game Commission.

The canner pays for the fish received in a lump sum to the Fishermen's organization twice a month.

Disputes in future to be submitted to arbitration before a strike is called. An arbitration board to consist of three: A representative of the fishermen, and a representative of the packers, these two to choose a third, an outsider.

When a crew is set a definite limit by its organization and delivers an excess, the payment for that excess goes into the treasury of the organization and the crew receives nothing for it. Also, during periods of so-called scarcity of fish, the canner need not order a definite tonnage, but may order a total catch of the usual number of crews fishing for his plant. This is just as in the past, when limits were removed during scarcity.

If this agreement holds, it will settle several of the difficulties of the Fish and Game Commission's administration. Most important of all, it will insure the delivered tonnage of fish being recorded on the official receipts issued by the canner to the fishermen, also, minor questions will be easier to handle, such as overcatches and the dumping of fish. Although these matters have been agreed upon by both sides in the controversy, it appears to be difficult for some of the canners to adjust themselves to the revolutionary idea of dealing with the Fishermen's organization, rather than with the separate crew of captains.—W. L. S.

HALIBUT IN CALIFORNIA.

Fishing boats working out of Eureka, California, this year have made some fairly good catches of "Northern" halibut, sufficient to stock the San Francisco market. The halibut is supposed to be scarce on the coast of California, although the large flounder known locally as "California" halibut is plentiful, especially in the southern part of the state.

The Western California Fish Company of San Francisco equipped several boats to fish for halibut off the Eureka coast, as an experiment, with the result that good catches were made. The halibut caught were fine big fish, in excellent condition, and with properly equipped boats, we feel confident good catches will continue to be made.—E. D.

WATER POLLUTION.

The State of California, through the Fish and Game Commission, has done a great deal to prevent the pollution of our waters with oil, mill and factory waste. It even has succeeded in getting some good laws on the statute books, but a great deal of work remains to be done.

Due to the great development of the oil industry in this state, our greatest problem is in the mattter of oil pollution. The oil is piped from the oil fields to our harbors, where it is stored, refined and loaded on ships for fuel and transportation.

At the present time the Fish and Game Commission has the cooperation of the various oil companies, shipyards, steamship companies and railroads in preventing oil from getting into our waters. With all this the oil frequently gets away, through accident or carelessness and causes great damage to harbors, loss to bathing beaches, pleasure boats and other water craft. The piling around the various piers become covered with oil which adds greatly to the fire hazards. Recently it became necessary for the San Francisco Harbor Commission to post signs on all wharves along the water front, prohibiting smoking. This was due to the fact that the pilings were saturated with oil and to prevent disastrous fires, these measures were taken.

The principal concern of the Fish and Game Commission is the damage and destruction to bird and fish life. The feathers of the various kinds of waterfowl become saturated with oil, so that they can not fly and sooner or later die. The loss of water birds, such as wild ducks, from this cause is at times very serious.

Young clams on the beaches and mud flats are killed by coming in contact with the oil. The fish are damaged indirectly by lack of food, caused by the oil killing the diatoms and other plankton which form the basis of the food supply for our fish. It may be that oil pollution is a more serious menace to the fish of our inland waters than overfishing.

Some of the worst offenders are ships that come into our harbors, which after unloading their cargoes, and before taking on a new supply of fuel oil, pump the ship's bilges into the bay. Shipyards that repair tankers, or oil carrying barges, are sometimes careless in taking care of oil that comes from these ships, also garages that empty their greases into the public sewers, which in many instances empty into rivers or bays.

To stop all pollution of our waters, this Commission invites the cooperation of all civic organizations, the assistance and cooperation of all manufacturing plants, oil companies, shipyards, steamship companies, railroads, garages and gas companies. and we are sure that with the help of these organizations, it will be possible to keep the waters of California clean.—E. D.

CONSERVATION IN OTHER STATES.

NEW GAME PRESERVES FOR LOUISIANA.

Edward Avery McIlhenny, donor to the State of Louisiana of the Rockefeller-Sage and Rainey-McIlhenny game preserves has recently acquired additional land which, added to what he already owned, will give him control of a total of 100,000 acres of land in the game regions along the gulf coast. Mr. McIlhenny announces that game will be protected on this area, which means that wild life will now be safeguarded on all of the territory from the mouth of the Mississippi to Texas along the Gulf coast line for a distance of 75 miles and an area of 700 square miles inland. For several years Mr. McIlhenny has been following a broad and far-sighted policy of game conservation. This 100,000 acres, though very fertile land is not being developed for agricultural purposes. Instead, an interlacing system of ponds, canals and lakes is being laid out and the whole region planted with the food plants of wild game birds. This provides permanent feeding grounds on protected areas for the millions of waterfowl and other game birds which annually migrate to this region. Many game animals and fur-bearers also frequent these feeding grounds and a force of wardens is employed by Mr. McIlhenny to see that the game laws are enforced. Who will do as much for California?

HUNTING ACCIDENTS REDUCED IN WYOMING.

Game laws in Wyoming now require every hunter to wear some distinguishing mark on his hat. The last Biennial Report of the Wyoming Fish and Game Commission reports that no accidents occurred during the 1921 open season and this is attributed to this new law.

COMMON SENSE.

"The man who violates the fish and game laws is cheating you. Help us to educate him, or to punish him if he is a wilful offender."—New Jersey Fish and Game Commission.

DEPREDATIONS OF DEER IN NEW JERSEY NEGLIGIBLE.

New Jersey allows the killing of deer trespassing upon cultivated lands. The person killing a deer because of depredations must report to the Fish and Game Commission within 48 hours. The fact that but two deer were so killed and reported makes it evident that depredations by these animals have been greatly exaggerated. Every state which has provided for remuneration for the damage of crops has proved the same thing.

NEW JERSEY TO INTRODUCE RABBITS.

New Jersey is now planning the introduction of snowshoe rabbits. However, inability to secure a supply from other states is causing some delay in carrying out the plan.

MINNESOTA REPORTS DEER DEPLETION.

The 1922 Biennial Report of the Minnesota Fish and Game Commission records a kill of 18,000 deer annually. Minnesota is one of the only states in the Union that still allows the killing of does and fawns and it is estimated that half of the total kill is made up of animals of these categories. The Commissioner reports a steady depletion in the deer as a result of extensive hunting and the destruction of does and fawns.

Apparently it is almost impossible for one state to profit by the experience of another. It must experience evident depletion itself before taking measures to conserve a supply. The trouble is, quite often these measures come altogether too late to give satisfactory results.

Minnesota now boasts of 69 game refuges. Many of them, however, are of small size.

Fur farming is to be a considerable industry in Minnesota for the breeding stock of the various game farms is valued at $657,390. There are 1600 foxes and 375 skunks used as breeding stock on the various fur farms.

VERMONT NOW HAS BUCK LAW.

The Biennial Report of the Vermont Fish and Game Commission reports a reduction in the deer kill from 4477 in 1920, to 1507 in 1921, with the inauguration of the buck law. Doubling of the season from 6 days to 12 days gave only about one-third the normal kill when both does and bucks were allowed to be killed.

NEW MEXICO PROVIDES RESTING AREAS FOR WATERFOWL.

New Mexico has provided nine resting areas for ducks on the Rio Grande River. Certain areas located below some of the more prominent bridges across the river are designated as resting areas and the penalty for shooting on these areas is set at a fine not exceeding $300 and imprisonment not exceeding 30 days.

FAVORITE LAKE FOR BIRDS SAVED TO MINNESOTA.

Swan Lake, a valuable and unusual body of water about 10,500 acres in area, located in Nicollet County, Minn., has been saved to the state through the efforts of the State Game and Fish Commissioners, the Biological Survey of the United States Department of Agriculture and landowners and local conservationists of the region. A movement to lower the level of the lake four feet, eventually draining it entirely, was successfully opposed and defeated at two hearings after an examination of the wild fowl and food plant value of the lake had been made by three representatives of the Biological Survey.

In deciding this case the District Court in Minnesota laid emphasis on the great importance to the public welfare of such bodies of water as Swan Lake. Its favorable location, its relatively shallow fresh water, and its abundant growth of vegetation suitable for cover, nesting sites, and food have made it an attractive resort for many kinds of waterfowl. Its margins and wooded islands are a valuable asset in the conservation not only of game birds but also of insectivorous birds useful to farmers. Among the water birds that breed on the lake are several species of ducks, including mallards, blue-winged teal, redheads, lesser scaup, and ruddy ducks; sora rails, Florida gallinules, American coots, four species of grebes, black terns, and black-crowned night-herons are also common.

At least 50 kinds of plants valuable as food for water birds grow in this lake, including practically all the best duck food plants of the United States. There is also an abundance of fresh-water snails of several species liked by water birds. Lowering the level of this lake materially would eventually cause the disappearance of its present kind of vegetation and gradually destroy its value as a waterfowl resort.

WEST VIRGINIA ESTABLISHES REFUGES.

West Virginia is one of the later states to join the conservation movement, its Game and Fish Commission having been created in 1921 and its fish and game code enacted by the legislature of that same year. It is, however, pursuing an intelligent and vigorous policy of protecting and building up its many resources of forest and stream and it appears that these efforts are meeting with satisfactory response. Appreciation of the value of game preserves is evidenced in the statement of the Chief Game Protector, Mr. A. B. Brooks, in the July bulletin of the American Game Protective Association. "The West Virginia law authorizes the purchase and protection of lands for park and game preserve purposes; but since the total revenue for forest, fish and game work is derived from hunting and fishing license fees, the funds necessary for these purposes are not yet available. To avoid waste of time, however, the commission is establishing game refuges on privately owned lands. Seven such refuges have been set aside, having a combined area of about 22,000 acres. This number will be increased as rapidly as possible."

INCREASED LICENSE FEES.

During the past year, increased license fees were provided for in Pennsylvania, Tennessee, Utah, Manitoba, Northwest Territories, and New Brunswick. Evidently Canada is just as progressive as the United States. If sportsmen continue their demands for more and more fish and for better patrol service, increased funds will be necessary. There has been increasing sentiment favoring a higher license fee for the angler. Proposed legislation looking in this direction failed to receive favorable action at the last legislature.

NEVADA ESTABLISHES GAME REFUGES.

A new Nevada law authorizes the governor to select and set aside areas of the public domain, not exceeding 25 in number, as recreation grounds and game refuges. On June 30th a proclamation was issued setting aside recreation grounds and game refuges as follows: Jarbidge, approximately 40,300 acres, and Humboldt, approximately 206,800 acres, in Elko County; Santa Rosa, approximately 64,000 acres, in Humboldt County; Grant, approximately 377,500 acres, and Reese River, approximately 198,500 acres, in Nye County, and an addition to the Grant refuge, approximately 25,600 acres, in Lincoln County; Lehman, approximately 175,512 acres, and Schell Creek, approximately 70,400 acres, in White County; an antelope preserve in Washoe County, comprising that portion of the public domain north of township 33 north; a sanctuary for quail and pheasants, extending from the north bank of the Truckee River to a line parallel with it and one mile uniformly distant, limited on the west by the Glendale bridge and on the east by the Derby dam; a refuge in Clark County, comprising that portion of the public domain lying between the south line of township 16 south and the north line of township 22 south, ranges 55 to 58 east, comprising approximately 403,200 acres; and a refuge in Lander County, located on Birch, Kingston, Washington, and Big Creeks.—U. S. Dept. Agric. Farmers' Bull.; No. 1375.

MICHIGAN HITS SHOOTING MONOPOLY.

To prevent the monopolizing of shooting rights, Michigan has enacted a law which restricts the size of private preserves of hunting grounds to not more than 15,000 acres in one tract, and prohibits the establishment of a new preserve within two miles of one already in existence.

FRANCE ENTERTAINS PROTECTIONISTS.

France, as represented by the Societe d'Acclimatation de France and the Litue pour la Protection des Oiseaux, held an International Conference on the Protection of Nature, "Sites et Monuments Naturels," during June, 1923. M. Delacour, President of the Ligue, presided over the section dealing with fauna. Reserves, public parks and gardens, as well as wild life conservation were subjects for discussion.

REPORTS.

STATEMENT OF INCOME.

For the Period July 1, 1922, to June 30, 1923, of the Seventy-fourth Fiscal Year.

License Sales:	Detail	Total
Angling	$217,077 00	
Hunting	249,521 00	
Market fishermen's	46,510 00	
Wholesale fish packers'	1,170 00	
Trapping	3,119 00	
Game breeders'	152 50	
Fish breeders'	40 00	
Fish importers'	5 00	
Kelp	10 00	
Total license sales		$517,604 50
Other Income:		
Court fines	$30,803 00	
Fish tag sales	3,111 09	
Fish packers' tax	38,033 44	
Game tag sales	7 01	
Sale of nets	140 00	
Sale of launch	60 00	
Sale of typewriter	22 50	
Crawfish inspection	210 00	
Total other income		72,387 04
Total income		$589,991 54

STATEMENT OF INCOME.

For the Period April 1, 1923, to June 30, 1923, of the Seventy-fourth Fiscal Year.

License Sales:	Detail	Total
Angling	$78,317 00	
Hunting	32,954 00	
Market fishermen's	17,830 00	
Wholesale fish packers'	90 00	
Trapping	321 00	
Game breeders'	87 50	
Fish breeders'	5 00	
Total license sales		$129,604 50
Other Income:		
Court fines	$7,653 00	
Fish tag sales	326 10	
Fish packers' tax	28,711 84	
Sales of nets	140 00	
Sale of launch	60 00	
Sale of typewriter	22 50	
Crawfish inspection	210 00	
Total other income		$37,123 44
Total income		$166,727 94

STATEMENT OF EXPENDITURES.

For the Period July 1, 1922, to June 30, 1923, of the Seventy-fourth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			$546 35		$546 35
Executive offices	$346 32	$16,173 20	5,737 46	$903 78	23,160 76
Printing			4,149 13		4,149 13
Research and publicity	226 71	4,339 27	695 28	370 00	5,631 26
Accident and death claims			2,702 43		2,702 43
Department totals	$573 03	$20,512 47	$13,830 65	$1,273 78	$36,189 93
Commercial fishculture and conservation:					
Superintendence	$137 24	$10,381 58	$5,398 05	$219 37	$16,136 24
Inspection and patrol	4,694 25	21,798 19	6,756 84	194 74	33,444 02
Research	200 65	17,204 28	2,166 35	314 13	19,885 41
Statistics	676 02	4,698 87	158 51	5 25	5,538 65
Market fishing license commissions			482 00		482 00
Propagation and distribution of salmon	6,674 27	14,033 92	988 80	594 50	22,291 49
Department totals	$12,382 43	$68,116 84	$15,950 55	$1,327 99	$97,777 81
Sporting fishculture and conservation:					
Superintendence	$362 62	$10,286 31	$29,828 78	$6 25	$40,483 96
General patrol (40 per cent)	1,067 36	48,185 27	31,126 46	268 93	80,648 02
Propagation and distribution of trout	26,730 12	61,740 16	23,498 76	5,938 80	117,907 84
Department totals	$28,160 10	$120,211 74	$84,454 00	$6,213 98	$239,039 82
Game conservation:					
Superintendence		$1,528 06	$36,564 91		$38,092 97
General patrol (60 per cent)	$1,601 04	72,277 90	46,689 69	$403 39	120,972 02
Department totals	$1,601 04	$73,805 96	$83,254 60	$403 39	$159,064 99
Tahoe camping ground	$120 82	$659 25	$19 08		$799 15
Grand totals	$42,837 42	$283,306 26	$197,508 88	$9,219 14	$532,871 70

STATEMENT OF EXPENDITURES.

For the Period April 1, 1923, to June 30, 1923, of the Seventy-fourth Fiscal Year.

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Commissioners			$147 52		$147 52
Executive offices	$221 39	$4,170 66	1,422 74	$687 73	6,502 52
Printing			845 04		845 04
Research and publicity	—95	1,050 00	1 20		1,050 25
Accident and death claims			752 77		752 77
Department totals	$220 44	$5,220 66	$3,169 27	$687 73	$9,298 10
Commercial fishculture and conservation:					
Superintendence	$63 41	$2,665 00	$1,873 75	$168 32	$4,770 48
Inspection and patrol	2,193 59	5,635 00	2,144 16	72 90	10,045 65
Research	38 10	3,961 73	206 57	110 70	4,317 10
Statistics	674 94	1,110 00	74 19	5 25	1,864 38
Market fishing license commissions			156 00		156 00
Propagation and distribution of salmon	2,508 35	2,426 32	180 28	518 83	5,633 78
Department totals	$3,478 39	$15,798 05	$4,634 95	$876 00	$26,787 39
Sporting fishculture and conservation:					
Superintendence	$72 19	$2,440 50	$9,254 14		$11,766 83
General patrol (40 per cent)	502 77	12,074 07	7,926 64	$253 25	20,756 73
Propagation and distribution of trout	9,917 86	18,786 21	3,652 45	5,702 29	38,058 81
Department totals	$10,492 82	$33,300 78	$20,833 23	$5,955 54	$70,582 37
Game conservation:					
Superintendence		$300 00	$11,418 98		$11,718 98
General patrol (60 per cent)	$754 14	18,111 09	11,889 97	$379 87	$31,135 07
Department totals	$754 14	$18,411 09	$23,308 95	$379 87	$42,854 05
Tahoe camping ground	$112 22	$195 00	$16 83		$324 05
Grand totals	$17,058 01	$72,925 58	$51,963 23	$7,899 14	$149,845 96

CALIFORNIA FRESH FISHERY PRODUCTS FOR MONTHS OF APRIL, MAY AND JUNE. 1923.

Compiled by Fish and Game Commission, Department of Commercial Fisheries.

Species of fish	Del Norte, Humboldt	Mendocino Sonoma, Lake	Marin	Solano, Yolo	Tehama, Colusa, Glenn, Butte	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Mexican, brought into California via San Pedro	Mexican, brought into California via San Diego
Albacore												181,458	140	26,199	207,797		
Anchovies								5,100		2,275		5,788			13,163		
Barracuda											719	2,833,531	27,032	313,822	3,205,137	120,224	2,170
Bluefish									90	13,477					13,567		
Boccaccio	13							12,942	92,215	129,308	5,203				239,681		
Bonito												4,804		4,358	9,162		730
Carp						1,374	35,642	7,654							44,670		
Catfish		5,169		442		23,509	59								29,179		
Chilipepper								20,570	805						21,375		
Cultus Cod	1,956	211	332					27,221	6,379	8,309				109	44,517		
Dolphin																	
Eels														117	117		
Flounders	529		31	1,974			2,299	39,443	6,178	880		156		67	51,557		
Grayfish								2,424				2,230		73,878	78,532		
Greenfish																	
Hake								20,357	3,512						23,869		
Halibut	34,640	128						5,055	2,641	1,943	82,378	241,046	22,102	68,501	458,431	13,307	101,192
Hardhead																	
Herring			800					300	30						1,130		
Kingfish									14,682	85,306		34,080		3,481	137,549	7,700	20
Mackerel									40	62,356	371	473,571	21,428	83,368	641,134	200	255
Marlin																	
Mullet														2,850	2,850	300	9,503
Perch	6,894		2,290				40	10,706	1,026	3,853	561	35,958		160	61,191		
Pike						70	277	88							435		
Pompano								16		74		6,503	10	261	6,864		
Rock Bass											817	57,352	2,583	57,378	118,130	2,238	270
Rockfish	1,008	359	3,037					69,806	32,178	91,301	19,073	243,995	7,946	259,625	728,328	160	5,582
Sablefish								104,795	10,670	247					115,712		
Salmon	182,408	386,011	11,693	82,328	26,801	151,256	236,773	546,061	256,912	372,225					2,555,501		
Sandabs								301,503	54,604	1,246	133	3,383	233		361,102		
Sardines								81,390		2,002,150		5,801,807		961,760	8,856,107		
Sculpin												12,481	22	7,011	19,514		
Sea Bass—Black											600	11,138	188	13,070	24,996	165	7,960
Sea Bass—White										23	19,418	762,943	5,169	96,191	883,744	58,665	29,645
Sea Trout										38				1,878	1,916		1,955
Shad						160	937	21,375							25,472		
Shad—Buck				43,467		21,679	309,692	27							374,865		
Shad - Roe				104,603		37,176	631,077								772,856		

Sheepshead	------	------	------	------	------	------	------	------	------	------	148	174	------	1,650	1,972	------	------
Skates	------	------	------	------	------	------	------	21,775	1,125	325	------	85	------	------	23,310	------	------
Skipjack	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Smelt	5,015	------	18,670	------	------	------	82	12,091	6.213	939	19,147	76,370	724	1,196	140,447	------	80
Sole	315	------	182	------	------	------	270	1,330,428	213 328	40,220	19,888	9,629	2,073	1,520	1,617,853	------	482
Splittail	------	------	------	------	------	20	------	------	------	------	------	------	------	------	20	------	------
Striped Bass	------	------	740	40,025	------	97,952	224,211	51,980	------	------	------	------	------	------	414,908	------	------
Stingaree	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Suckers	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Surf Fish	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Swordfish	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Tomcod	------	------	------	------	------	------	------	2,957	------	------	------	------	------	------	2,957	------	------
Trout—Farm	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Trout—Steelhead	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Tuna	------	------	------	------	------	------	------	------	------	------	------	137,645	------	------	137,645	142,547	------
Tuna—Bluefin	------	------	------	------	------	------	------	------	------	------	------	571,568	------	818,413	1,390,011		------
Tuna—Yellowfin	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	278,539	------
Turbot	------	------	129	------	------	------	------	------	------	------	------	------	------	------	129	------	------
Whitebait	15,252	------	751	------	------	------	------	21,928	------	830	------	------	------	------	38,761	------	------
Whitefish	------	------	------	------	------	------	------	------	------	------	------	3,333	595	780	4,708	118	------
Yellowtail	------	------	------	------	------	------	------	------	------	------	------	275,776	1,398	561,734	838,908	12,475	2,238
Miscellaneous	200	------	------	406	------	12	17	14,279	1,981	1,041	2,240	22,913	131	2,850	46,070	1,710	1,450
Total Fish	518,230	391,908	38,655	273,245	26,804	336,208	1,441.376	2,738,274	704,609	2,818,366	170,729	11,812,720	91,774	3,395,257	24,788,155	638,348	163,532
Crustaceans:																	
Crabs	[1]64,296	[2]48	[3]792	------	------	------	------	[6]97,992	[9]3,312	[10]408	------	------	------	------	166,848	------	------
Ecrevisse	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Shrimps	------	------	87,197	------	------	------	------	120,933	------	------	------	------	------	------	208,130	------	------
Spiny Lobsters	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	66,693
Mollusks:																	
Abalones	------	------	------	------	------	------	------	------	15	538,554	11,010	------	------	------	549,579	7,575	------
Clams—Cockle	1,712	------	9,416	------	------	------	------	------	------	------	------	2,250	------	------	13,378	------	------
Clams—Mixed	1,084	------	2,985	------	------	------	------	------	------	------	------	------	------	------	4,069	------	------
Clams—Pismo	------	------	------	------	------	------	------	------	------	------	59,245	------	------	------	59,245	------	------
Clams—Softshell	------	------	19,920	------	------	------	36,443	11,799	------	------	------	------	------	------	68,162	------	------
Cuttlefish	------	------	219	------	------	------	------	2,085	9,617	11,154	------	169	------	------	23,274	------	------
Limpets	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Mussels	------	------	230	------	------	------	197	1.018	------	2,600	60	------	19,100	------	23,205	------	------
Oysters—Eastern	------	------	[4]77,924	------	------	------	------	[7]54,725	------	------	------	------	------	------	132,649	------	------
Oysters—Native	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Snails	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Squid	------	------	------	------	------	------	------	------	------	889,986	------	------	------	------	889,986	------	------
Miscellaneous:																	
Frogs	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Terrapins	------	------	------	------	------	[5]72	------	------	------	------	------	------	------	------	72	------	------
Turtles	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Totals	615,322	391,956	237,338	273,245	26,804	336,280	1,478,016	3,026,826	717,583	4,261,068	241,044	11,815,139	110,874	3,395,257	26,926,752	645,923	230,225

All amounts shown in pounds. Albacore cleaned. [1]2,679 doz. [2]2 doz. [3]33 doz. [4]354,200 shell oysters. [5]3 doz. [6]4,083 doz. [7]218,750 shell oysters. [9]138 doz. [10]17 doz.

VIOLATIONS OF FISH AND GAME LAWS, FISCAL YEAR 1922-1923.

	1922		1923	
HUNTING.	July-Sept.	Oct.-Dec.	Jan.-April	March-June
Without hunting license	25	36	16	5
License, failure to show	1	5		
Quail, closed season	15	13	1	
Quail, sale of				1
Quail, trapping of		1		
Wild pigeons, closed season	1	9	9	2
Grouse, closed season	1			1
Sage-hens, closed season	2			1
Pheasants, closed season	2		2	
Ducks, closed season	17		22	4
Ducks, over limit		6		
Mud hens, closed season	1			
Geese, closed season			1	2
Geese, over limit		3		
Shore birds, closed season		19	2	
Doves, closed season	21			2
Non-game birds	2	18	10	5
Rabbits	10	3	2	4
Squirrels			1	
Deer, closed season	19	15	26	8
Deer, killing of does and fawns	5	8	5	1
Deer, over limit		1		
Deer, dogs, closed season		2		1
Deer, illegal heads or hides	5	9		
Mountain sheep				1
Shooting from auto	2	1		
Shooting from power boat		5		
Hunting in game refuge	3	2	3	6
Nighting hunting	1	27	6	
Trespassing		16		1
Totals	165	201	108	45
FISHING.				
Without angling license	10	6	15	40
Trout, closed season		1	31	33
Trout, over limit	5	5	4	24
Trout, illegally taken	10	2	2	5
Salmon, over limit		1	1	
Salmon, illegal sale		1		
Salmon, illegal spearing	2			
Black bass, closed season			2	7
Black bass, under size	3			6
Black bass, buy or sell	2			
Striped bass, over limit	5	1		2
Striped bass, under size	5	1		21
Striped bass, over size				1
Striped bass, illegal sale	2	1	1	
Crappie, closed season			1	
Sunfish, closed season				1
Perch, closed season				1
Perch, sale			1	
Catfish, sale of undersized			2	
Barracuda, undersize	2			8
Halibut, undersize		3		
Sturgeon, closed season	2			
Abalones, closed season			6	
Abalones, undersize	2	5	1	25
Abalones, over limit	1	4		9
Abalones, illegal shipment			1	
Abalones, drying	1			
Abalones, brought ashore dead		1		
Clams, closed season				1
Clams, over limit	2	7	12	6
Clams, undersize	7	26	28	8
Clams, illegal shipment			1	
Crabs, undersize		3	6	7

VIOLATIONS OF FISH AND GAME LAWS, FISCAL YEAR 1922-1923—Cont'd.

	1922		1923	
FISHING—Continued.	July-Sept.	Oct.-Dec.	Jan.-April	March-June
Crabs, illegal shipment			2	2
Lobsters, closed season	2		1	3
Lobsters, undersize		18	2	
Lobsters, oversize		3		
Within 250 feet of fishway		2	4	7
Taking from spawning station				2
Killing fish with dynamite	1		1	
Obstruction in stream				1
Night fishing	3			5
Without commercial license	43	2	2	
Destroy food fish			1	
Illegal use nets, traps, lines, etc.	16	7	5	16
Commercial fishery data; failure to keep			1	
Ship fish by parcel post	1			
Water pollution			2	
Totals	128	100	137	250

CASES.

Recapitulation (as of December 1, 1923). July 1, 1922, to June 30, 1923.

	July, Aug., Sept.	Oct., Nov., Dec.	Jan., Feb., March	April, May, June	Total for year
Convictions	228	227	198	232	885
Bail forfeited	19	30	2	19	70
Sentence suspended	28	33	21	31	113
Pending	9	2	3	3	17
Dismissal-acquittal	7	4	9	6	26
Juvenile	2	5	12	4	23
Total arrests by quarters	293	301	245	295	
Total arrests for year					1,134

ARRESTS, FISCAL YEAR, JULY 1, 1922–JUNE 30, 1923.

	1922		1923		
Nationality	July-Sept.	Oct.-Dec.	Jan.-March	April-June	Totals
Citizen	133	138	143	155	569
Armenia	1				1
Austria	20	3	4	4	31
Canada				1	1
China	2		4		6
England	1			2	3
France	1	5	1	13	20
Greece	4	6	2	2	14
Germany			2	5	7
Guatemala	1				1
Ireland	1	2		1	4
Italy	33	38	28	23	122
Japan	13	10	13	20	56
Mexico	4	2	2	1	9
Norway		2		1	3
Portugal	6	15	5	6	42
Russia	2	2			4
Scotland				1	1
South Wales			1		1
Spain		1		3	4
Sicily		2			2
Serbia	1	1			2
Sweden	3	2		2	7
Switzerland	1		2		3
Not given	66	72	37	55	230
Totals	293	301	245	295	1,133

SEIZURES, FISCAL YEAR, 1922–1923.

	1922		1923	
	July-Sept.	Oct.-Dec.	Jan.-March	April-June
Ducks	284	2,478	706	8
Geese		51	10	4
Shore birds		27	12	
Quail	11	53	14	
Grouse	1			2
Sage-hens	27			
Wild pigeons		9	5	1
Doves	79			
Pheasants			3	
Non-game birds		7	31	
Deer meat (pounds)	543	259	412½	77
Deer hides	2	1	2	
Mountain sheep heads				2
Rabbits	21	4		1
Trout	108	33	9	657
Trout (pounds)		574½	235½	74¾
Salmon (pounds)	1,151	834	927	89½
Catfish (pounds)			177	
Black bass	44			102
Striped bass	183			103
Striped bass (pounds)	964	544½	173	342
Barracuda (pounds)	875	600		11,431
Halibut (pounds)		1,050		
Sturgeon (pounds)	254			
Whitebait (pounds)				40
Crappie				8
Sunfish				44
Hardhead				31
Crab	2,188	1,873	271	671
Crab meat (pounds)		10		85
Lobster	70	145	25	
Lobster (pounds)	100	1,536		507
Lobster	1 box		15 boxes	10 sacks
Abalone	117	125	162	308
Clam	240	1,075	271	845
Clam (pounds)			40	
Mussel	260			
Shrimp (pounds)			10	
Shrimp meat (pounds)				160

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